DOE/RL-2004-55
Draft A

Engineering Evaluation/ Cost Analysis for the Final Configuration of the 105-B Reactor Facility

United States
Department of Energy

For External Review

DOE/RL-2004-55
Draft A

Engineering Evaluation/Cost Analysis for the Final Configuration of the 105-B Reactor Facility

July, 2004

United States Department of Energy

P.O. Box 550, Richland, Washington 99352

EXECUTIVE SUMMARY

This document presents the results of an evaluation of three removal action alternatives for the final configuration of the 105-B Reactor Building pending eventual disposition of the reactor core by 2068. Portions of the 105-B Reactor Building and the 116-B Reactor Exhaust Stack are contaminated with chemical and radiological hazardous substances and pose a potential risk to human health and the environment, warranting a final removal action. An interim removal action decision for a time frame of up to 10 years was documented in an action memorandum in 2001, which included hazard mitigation and potential public access of the 105-B Reactor Building (DOE-RL 2001c). To date, approximately 85% of the hazard mitigation removal actions stipulated in the 2001 action memorandum have been completed. Achievement of the remainder of the hazard mitigation removal actions will continue through 2011 or until a final disposition pathway is determined.

In accordance with previous commitments, the U.S. Department of Energy (DOE) is continuing to seek a sponsor with interest in preserving all or part of the 105-B Reactor Building for historical purposes. To date, such a sponsor and funding have not been identified, although efforts continue. The alternatives summarized in this evaluation enable the DOE to begin the planning and budgeting process for a final configuration of the 105-B Reactor Building with the assumption that a long-term sponsor cannot be found and there will be no long-term public use or structural preservation of the facility. This engineering evaluation/cost analysis is also being prepared to comply with *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone C-16-06E, "Final Configuration for B Reactor." Actions evaluated in this document would be implemented, pending public approval, as a removal action under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA).

This document briefly describes the 105-B Reactor Building, its historical significance, and interim action alternatives already selected for historic preservation. The document also describes site conditions and the sources and extent of contamination to provide a framework for the discussion of removal action objectives and alternatives. Finally, each alternative is compared against the criteria of effectiveness, implementability, and cost.

Removal actions evaluated for the 105-B Reactor Building include no action, interim safe storage, and long-term surveillance and maintenance. The no action alternative assumes all short-term and long-term maintenance of the facility is terminated and the facilities are locked to prevent entry. Interim safe storage, which has been performed or is in progress at other Hanford Site reactor facilities, includes decontamination and demolition of the reactor facility up to the shield walls that surround the reactor block, the construction of a safe storage enclosure, and a reduced schedule of surveillance and maintenance. The long-term surveillance and maintenance alternative includes an extended period of facility monitoring with major and minor repairs as necessary followed by eventual decontamination and demolition of the reactor facility. This evaluation approach has been implemented at the Hanford Site 105-C, 105-D, 105-DR, 105-F, and 105-H Reactor facilities with ISS the preferred alternative selected.

Present-worth cost estimates for the three alternatives are shown in Table ES-1. Consistent with guidance established by the U.S. Environmental Protection Agency and the U.S. Office of Management and Budget, present-worth analysis is used as the basis for comparing costs of cleanup alternatives under the CERCLA program (EPA 1993).

Table ES-1. Cost Comparison for Final Configuration Alternatives for the 105-B Reactor.

Alternative	Present-Worth Cost
Alternative 1 – No Action	No cost
Alternative 2 – Interim Safe Storage	$19,623,000
Alternative 3 – Long-Term Surveillance and Maintenance	$25,870,000

The recommended removal action alternative at the 105-B Reactor Building is interim safe storage to begin at the conclusion of the 10-year interim mitigation program or when deemed appropriate by DOE and the regulatory agencies. This alternative is recommended based on its overall ability to protect human health and the environment and its effectiveness in maintaining protection for both the short term and the long term. The alternative would also reduce the potential for a release by reducing the inventory of contaminants. This alternative provides the best balance of protecting human health and the environment, protecting workers, meeting the removal action objectives, achieving cost effectiveness, and providing an end state that is consistent with future cleanup actions and commitments to the Tri-Party Agreement (Ecology et al. 1998).

TABLE OF CONTENTS

Table of Contents

APPENDIX

FIGURES

TABLES

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant difference
FR	*Federal Register*
FSB	fuel storage basin
ISS	interim safe storage
NEPA	*National Environmental Policy Act of 1969*
NPL	National Priorities List
OU	operable unit
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
ROD	Record of Decision
S&M	surveillance and maintenance
SSE	safe storage enclosure
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document presents the results of an engineering evaluation/cost analysis (EE/CA) conducted to evaluate removal action alternatives for the final configuration of the 105-B Reactor Building (subsequently referred to as the 105-B Facility[1]). The 105-B Facility is located in the 100-B/C Area of the Hanford Site and is currently being maintained under a 10-year hazard mitigation program to preserve the structure for historical purposes. To date, approximately 85% of the hazard mitigation removal actions stipulated in the 2001 action memorandum (DOE-RL 2001c) have been completed. Achievement of the remainder of the hazard mitigation removal actions will continue through 2011 or until a final disposition pathway is determined. However, no sponsor has been identified with adequate funding to preserve all or part of the 105-B Facility for long-term public use.

If no long-term sponsor and funding is available to preserve the 105-B Facility, the U.S. Department of Energy (DOE), Richland Operations Office (RL) is preparing for a final configuration where there is no further use for the facility. Hazardous substances[2] in the 105-B Facility and associated structures present a potential threat to human health and the environment to the extent that a removal action[3] is warranted before final disposition. An action memorandum, which will be developed from this EE/CA, will document and authorize implementation of the remedy that is selected for the 105-B Facility. Final disposition of the 105-B Reactor will be completed in accordance with the environmental impact statement (EIS) *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1992).

The scope of the proposed removal action at the 105-B Facility includes the fuel storage basin (FSB), below-grade portions of the reactor, miscellaneous structures near the 105-B Building, and the 116-B Reactor Exhaust Stack. Some contaminated soils associated with the 105-B Facility will be addressed during final disposition of the 105-B Reactor as described in the surplus reactors EIS (DOE 1992). The reactor block is also not included in the scope of this removal action.

---

[1] The term "facility" is used in a generic way to encompass all the structures, buildings, tunnels, piping, ducting, etc., associated with the reactor building.

[2] "Hazardous substances" means those substances defined by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), Section 101(14), and include both radioactive and chemical substances.

[3] "Remove" or "removal" as defined by CERCLA, Section 101(23), refers to the cleanup or removal of released hazardous substances from the environment; actions if a threat of release of hazardous substances occur; actions to monitor, assess, and evaluate the release (or threat of release) of hazardous substances; the disposal of removed material; or other actions that may be necessary to prevent, minimize, or mitigate damage to public health or welfare or to the environment, which may otherwise result from a release or threat of release. If a planning period of at least 6 months exists before onsite actions must be initiated, the removal action is considered non-time-critical and an EE/CA is conducted.

1.2 BACKGROUND

The Hanford Site is a 1,517-km^2 (586-mi^2) federal facility located in southeastern Washington State along the Columbia River (Figure 1-1) and operated by RL. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. The 100 Area is the site of nine now-retired nuclear reactors and associated support facilities that were constructed and operated to produce weapons-grade plutonium. Past operations, disposal practices, spills, and unplanned releases resulted in contamination of the facility structures, underlying soil, and underlying groundwater in the 100 Area. Consequently, in November 1989, the 100 Area was one of four areas of the Hanford Site that was placed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List (NPL) under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) as amended by the *Superfund Amendments and Reauthorization Act of 1986*.

The 100 Area NPL includes the 100-B/C Area, which is in various stages of the remediation process. The 105-B Facility is located in the 100-B/C Area of the Hanford Site. The 100-B/C Area is subdivided into three operable units (OUs) to address cleanup of the soil and groundwater contamination that resulted from past operations. The 100-BC-1 and 100-BC-2 OUs encompass liquid waste disposal sites, burial grounds, and soil waste sites. The 100-BC-5 OU addresses groundwater contamination underlying the 100-B/C Area. The majority of the original structures and facilities in the 100-B/C Area have been remediated. Interim safe storage (ISS) of the 105-C Facility was completed in 1998. The majority of the liquid waste sites and the ancillary facilities have been removed and closed out. The 105-B Facility is among the last remaining principal structures in the 100-B/C Area. The 105-B Facility is listed in the National Register of Historic Places and was designated a National Historic Civil Engineering Landmark in 1993.

Consistent with the *National Environmental Policy Act of 1969* (NEPA), an EIS has been prepared on the disposition of the Hanford Site reactors, which is documented in the surplus reactors EIS (DOE 1992). The purpose of the EIS was to provide environmental information to assist DOE in selecting a decommissioning alternative for these eight surplus reactors at the Hanford Site. The EIS Record of Decision (ROD) (58 *Federal Register* [FR] 48509) documented the DOE's selection of safe storage of these reactors followed by deferred one-piece removal of the reactor block. Additionally, in 1999 the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999) was prepared to provide a strategy for future land use on the Hanford Site. The EIS made allowance for the 105-B Reactor to be converted into a museum and the surrounding area made available for museum support facilities.

In 2001, the *Engineering Evaluation/Cost Analysis for the 105-B Reactor Facility* (DOE-RL 2001a) was prepared to analyze removal actions that may be performed at the 105-B Facility to protect human health and the environment. The interim removal action recommended in the EE/CA and selected in the associated action memorandum (DOE-RL 2001c) was hazard mitigation for a period of up to 10 years. Hazard mitigation is ongoing at the 105-B Facility and incorporates surveillance and maintenance (S&M) activities such as routine radiological and hazard monitoring and safety inspections. To date, approximately 85% of the hazard mitigation removal actions stipulated in the action memorandum have been completed. The action memorandum allowed interim use of the facility while a decision on the final configuration of the facility was decided. In accordance with these commitments, the DOE is continuing to seek a sponsor with funding to preserve all or part of the 105-B Facility for historical purposes. However, such a sponsor has not yet been identified. Currently, the Senate has passed a resolution to study Manhattan Project sites owned by DOE, including 105-B Reactor, for inclusion into the National Parks System.

Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone C-16-06E, "Final Configuration Determination for B Reactor," requires RL to make a recommendation to EPA by September 2005 concerning the configuration of the B Reactor for the interim period until final disposition is completed under the surplus reactors EIS (DOE 1992). This EE/CA is being prepared to meet Tri-Party Agreement Milestone C-16-06E (Ecology et al. 1998).

1.2.1 Waste Site and Soil Cleanup

Approximately 60 waste sites with a range of radioactive and nonradioactive contaminants have been identified in the 100-B/C Area as part of the 100-BC-1 and 100-BC-2 OUs. Remediation of these sites is being conducted under the following decision documents:

- *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (EPA 1995a)
- *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (EPA 1997)
- *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6 and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (EPA 1999a)
- *Declaration of the Record of Decision: U.S. DOE Hanford 100 Area; 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2 Operable Units, Hanford Site, Benton County, Washington* (EPA 2000).

The selected remedy specified in the RODs is removal of contaminated soil and debris to meet an assumed residential-use scenario, treatment (as necessary) to meet disposal facility acceptance criteria, and disposal. This remedy is commonly referred to as "remove, treat, dispose."

Remediation of waste sites in the 100-B/C Area is underway. The current planning baseline calls for completing remediation of all waste sites identified in the RODs by December 31, 2006, in accordance with Tri-Party Agreement Milestone M-016-45.

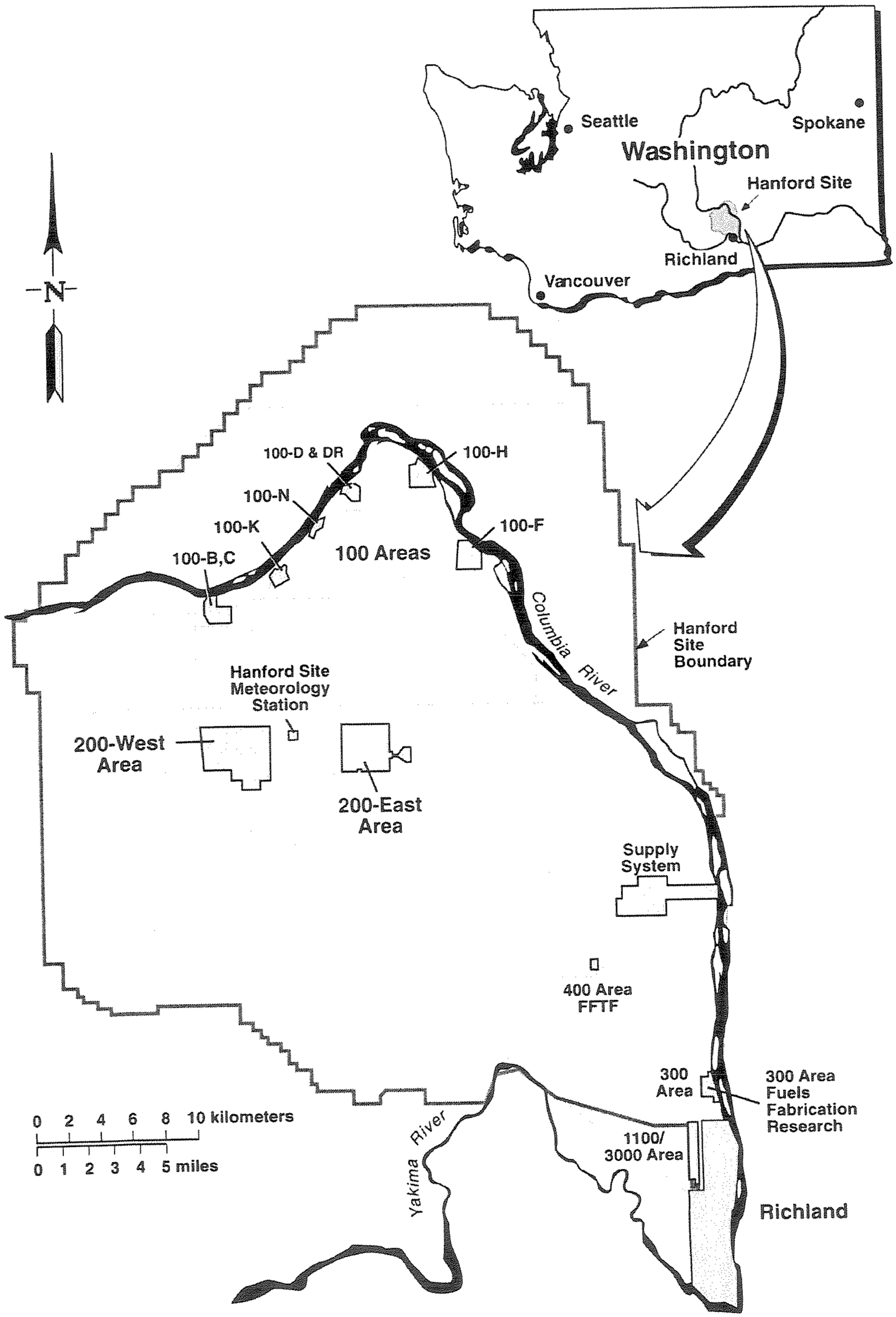
1.3 REMOVAL ACTION AUTHORITY

The *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (DOE and EPA 1995) is a joint policy between DOE and the EPA that allows use of the CERCLA removal action process (40 *Code of Federal Regulations* [CFR] 300.415) for deactivation and decontamination and decommissioning (D&D) activities. To qualify for inclusion in the removal action process, the facilities must contain hazardous substances. The non-time-critical removal action process also requires preparation of an EE/CA to identify and evaluate alternatives for proposed removal actions.

This EE/CA was prepared in accordance with CERCLA and 40 CFR 300.415 to satisfy environmental review requirements for non-time-critical removal actions and provide a framework to evaluate and select alternative approaches for remediation of the 105-B Facility. This EE/CA also specifies actions designed to comply with requirements of the DOE and EPA joint policy (DOE and EPA 1995) and the Tri-Party Agreement (Ecology et al. 1998). The EPA, Washington State Department of Ecology (Ecology), and DOE (referred to as the Tri-Parties) have determined that the facilities included in the scope of this EE/CA qualify for the removal action process based on the known presence of hazardous substances or the inability to conclusively exclude their presence. After the public has had an opportunity to comment on the alternatives and the recommended approach presented in this document, the Tri-Parties will select the most appropriate remedy for the facilities. As the lead regulatory agency, the EPA will prepare an action memorandum (a CERCLA decision document) to reflect the decisions made by the Tri-Parties.

In accordance with a Secretary of Energy policy statement (DOE 1994) and DOE O 451.1B, NEPA values have been incorporated into this EE/CA. The policy statement and DOE order encourage integration of NEPA values into CERCLA documents (such as this EE/CA) to the extent practicable rather than requiring separate documentation. A discussion of NEPA values is included in Section 5.0 of this document.

Figure 1-1. Hanford Site Map.



2.0 SITE CHARACTERIZATION

2.1 BACKGROUND AND SITE DESCRIPTION

Background information on the 100-B/C Area is provided in the following subsections, including operational history, land use and access, ecological setting, and cultural resources.

2.1.1 General Description of the 100-B/C Area of the Hanford Site

The 105-B Facility is located in the 100-B/C Area of the Hanford Site along the southern shore of the Columbia River in southeastern Washington State. The 100-B/C Area contains two inactive reactor facilities, the 105-B Reactor and the 105-C Reactor. The 105-C Reactor has undergone ISS and now exists in a safe storage enclosure (SSE) under a long-term S&M program. The 105-B Facility is currently managed under an S&M program to ensure continued protection of human health and the environment through hazard mitigation. Guided tours have occasionally been led through the 105-B Reactor along a maintained tour route. However, since September 11, 2001, public tours through the 105-B Facility have been severely curtailed. Support facilities for the 105-B and 105-C Reactors, with the exception of the 181-B River Pumphouse and the 182-B Reservoir and Pumphouse, have been demolished. Solid and liquid waste sites and underground pipelines are currently being remediated in the 100-B/C Area. The 116-B Reactor Exhaust Stack remains standing in the reactor exclusion area adjacent to the 105-B Facility.

2.1.1.1 Land Use and Access. Public access to the Hanford Site, including the 100-B/C Area, is currently restricted. Current land use in the 100 Areas consists of DOE spent fuel management activities and remediation activities at all of the reactor areas. The Columbia River, which is adjacent to the 100 Areas, is accessible to the public for recreational use (e.g., boating and sport fishing). The portion of river adjacent to the 100 Areas, referred to as the Hanford Reach, received National Monument status in 2000. Portions of the 100 Areas of the Hanford Site up to 0.40 km (0.25 mi) inland from the high-water mark, including portions of the 100-B/C Area, are included in the Hanford Reach National Monument, pending cleanup and hazard mitigation. The 105-B Facility itself is outside the boundaries of the monument.

In prehistoric and early historic times, the area along the banks of the Columbia River was a focal point for camping and village sites for northwest Native American tribes. More recently, before government acquisition of the land in January 1943, the area was used by Euro-American residents for irrigated and dry-land farming and livestock grazing.

The reasonably anticipated future use of the 100-B/C Area is preservation/conservation. This assumption is consistent with the "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)" (64 FR 61615), which provides four land-use designations in the Columbia River Corridor encompassing the 100 Area. These land uses are (1) preservation, (2) high-intensity recreation, (3) low-intensity recreation, and (4) conservation (mining). The river islands and a quarter-mile buffer zone along the river are designated as preservation to protect cultural and ecological resources. The high-intensity and low-intensity recreation designations are limited to specific sites and areas, none of which are in the 100-B/C Area. The remainder of land within the Columbia River Corridor outside the quarter-mile buffer zone is designated for conservation (mining). This designation will allow DOE to provide protection to sensitive cultural and biological resource areas, while allowing access to geologic resources in support of governmental missions or to further the biological function of wetlands (e.g., conversion of a gravel pit to a wetland by excavating to groundwater). Restrictions on certain uses may continue to be necessary to prevent mobilization of contaminants, the most likely example of such restrictions being on activities that discharge water to the soil or excavate below a specified depth.

2.1.1.2 Flora and Fauna. The ecological setting of the Hanford Site is described in *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Neitzel 2001). The upland habitats affected by the actions described in this document are rabbitbrush/cheatgrass communities and highly disturbed industrialized areas covered with rocky soils and sparse, weedy vegetation dominated by cheatgrass and Russian thistle.

Currently, there are no threatened or endangered plants (50 CFR 17) listed by the federal government on the Hanford Site. However, nine species of plants listed as threatened or endangered by Washington State are found on the Hanford Site (Neitzel 2001). Washington State has also listed mature sagebrush habitat as "priority habitat" because of the decline of these areas due to agricultural development.

Four animal species listed by the federal government as threatened or endangered are associated with the Hanford Site. The threatened/endangered species include the bald eagle (threatened), the peregrine falcon (endangered), the steelhead trout (endangered), and the spring-run Chinook salmon (endangered). Consultation with the appropriate U.S. Department of Interior agency is required under the *Endangered Species Act of 1973* to establish mitigation actions to prevent impact. This consultation for the bald eagle and the peregrine falcon is documented in the *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington* (DOE-RL 1994a). A similar plan, the *Threatened and Endangered Species Management Plan, Salmon and Steelhead* (DOE-RL 2000b), has been developed for steelhead trout and Chinook salmon that defines pre-approved mitigation actions and determines when further consultation is required.

Under Washington State listings for threatened and endangered species, four additional animal species are associated with the Hanford Site. These include the American white pelican, the ferruginous hawk, the Sandhill crane, and the western sage grouse. These species are not likely to be impacted by activities described in this document due to the distance of this project from available habitat for these species. However, if any of these species are identified in a project-specific ecological review, mitigation actions will be implemented to prevent impacts.

Within the 100-B/C Area, most of the area has been characterized as highly disturbed by industrial/waste management and remediation operations to the extent that plant communities are sparse and complete ecological communities represented by common food webs cannot be supported. No plants or animals on federal or state lists of endangered or threatened plants/wildlife are found in the 100-B/C Area. This characterization is representative of the geographical area defined by the facilities addressed by this EE/CA.

Before initiating a project on the Hanford Site, ecological reviews are required to ensure that impacts to sensitive plant or animal species will not occur. Because the 100-B/C Area is highly disturbed, the only significant ecological issue is nesting birds protected by the *Migratory Bird Treaty Act of 1918*. Annual baseline reviews include surveys for nesting birds and a reconnaissance to determine if any sensitive plants are growing in the 100-B/C Area. Following the annual review, the project will be notified of any active nests or sensitive issues and appropriate actions to be taken.

2.1.1.3 Cultural Resources. The 100-B/C Area bounds a culturally sensitive area, having been occupied prehistorically and historically by Native Americans and later by Euro-American settlers. Much of the 100-B/C Area, including the geographical area addressed in this EE/CA, has been extensively disturbed by building construction and general industrial activities.

Prior to initiating a project on the Hanford Site, a cultural resource review is required to ensure that impacts to cultural resources will not occur. A cultural resources review will be performed in compliance with the requirements of the *National Historic Preservation Act of 1966* and the *Programmatic Agreement Among the U.S. Department of Energy Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington* (DOE-RL 1996) to address the 105-B Facility.

2.2 HISTORICAL SIGNIFICANCE OF THE 105-B REACTOR

Groundbreaking for the 105-B Facility began in October 1943 (DOE-RL 2001a) by the U.S. Army Corps of Engineers as a part of the Manhattan Project effort to bring an end to World War II. In only 16 months the reactor was fully constructed and operational (DOE-RL 1998b). The first indications of radioactivity were observed on September 26, 1944, with the reactor achieving full power on February 4, 1945.

The 105-B Facility was the world's first full-scale production reactor. The reactor produced plutonium fuel for the world's first nuclear device, detonated at the Trinity test site in Alamogordo, New Mexico, on July 16, 1945. The facility also produced the plutonium fuel used in the atomic bomb, named "Fat Man," detonated at Nagasaki, Japan, on August 8, 1945, which hastened the end of World War II 5 days later.

Final shutdown of the reactor occurred on February 12, 1968, and the 105-B Facility was declared excess property in the early 1980s. Support facilities for the 105-B Facility, with the exception of the 181-B River Pumphouse and the 182-B Reservoir and Pumphouse, have been demolished. The 116-B Reactor Exhaust Stack still stands adjacent to the 105-B Facility in the southwest corner of the reactor area.

The 105-B Facility itself is considered a cultural resource. Because of its historical significance, the 105-B Reactor Building has been listed on The National Register of Historic Places and was designated a National Historic Civil Engineering Landmark in 1993. Documentation in the form of a Historic American Engineering Record was completed for the 105-B Reactor (DOE-RL 2001b). This documentation was completed as part of the *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington* (DOE-RL 1996). The contribution these structures made to the Cold War is described in *The Hanford Site Historic District*, Chapter 2, Section 3, "Reactor Operations" (DOE-RL 2002).

The historical significance of the 105-B Reactor has entitled it to numerous declarations, including National Historic Mechanical Engineering Landmark by the American Society of Mechanical Engineers in 1976 and the Nuclear Historic Landmark Award. From the late 1980s until September 2001, guided tours were led through portions of the 105-B Facility. Interpretive items and historical displays are exhibited in the facility along the current tour route. As the selected removal action is initiated, inventoried artifacts within the 105-B Facility will need to be housed in a suitable repository in accordance with the Programmatic Agreement. The Columbia River Exhibition of History, Science and Technology Museum, with a working agreement with RL, maintains the artifact inventory.

2.3 105-B FACILITY INTERIM REMOVAL ACTION

In 2001, the *Engineering Evaluation/Cost Analysis for the 105-B Reactor Facility* (herein referred to as "interim removal action EE/CA") (DOE-RL 2001a) was prepared to analyze removal actions that may be performed at the 105-B Facility to protect human health and the environment. This EE/CA differed from previous reactor facility EE/CAs because it was intended to support and implement DOE's decision to preserve the 105-B Facility for a period of up to 10 years. Based on this unique intended use, the selected removal action alternative supported use of the 105-B Facility for public access during the 10-year interim period (DOE-RL 2001a). The interim removal action recommended in the EE/CA and selected in the associated action memorandum was hazard mitigation for a period of up to 10 years. The hazard mitigation alternative included the removal of accessible hazardous substances from the 105-B Facility, while performing S&M activities such as routine radiological and hazard monitoring and safety inspections.

The interim removal action EE/CA analyzed removal action alternatives for a period of up to 10 years with the expectation that a final removal action, or "final configuration," would be determined during the 10-year period. Activities and associated costs for structural upgrades to allow sustained public access were identified during this interim time period to assess the feasibility of sustained public use and the associated risks to human health and the environment due to hazardous substances that remain in the facility. The 10-year time period is consistent with the DOE's Columbia River Corridor Initiative, the goal of which is to complete many cleanup and access decisions by the year 2012 and restore the river corridor per the M-93 Tri-Party Agreement milestone series (Ecology et al. 1998).

In addition to identifying and analyzing interim removal actions for the 105-B Facility, supplemental information was provided in the interim removal action EE/CA to help support decisions on the final configuration of the 105-B Facility. The supplemental information included the activities needed and estimated cost for mitigating hazards in all interior and exterior areas of the 105-B Facility to enable full public access for a 75-year period. To date, approximately 85% of the hazard mitigation removal actions stipulated in the action memorandum have been completed. This information was presented in Appendix B, Tables B-1 and B-2 of the interim removal action EE/CA (DOE-RL 2001a).

2.4 FACILITY DESCRIPTION

The 105-B Facility has been deactivated. Deactivation included de-energizing the nonessential electrical sources and equipment, preserving tools and equipment, conducting routine housekeeping and radiological surveys, and applying fixatives to many radiologically contaminated surfaces. The facility has not been fully decontaminated. Previous reports define the hazards to the public, workers, and the environment within the 105-B Facility. The *105-B Reactor Facility Museum Phase I Feasibility Study Report* (Griffin et al. 1995), the *Hanford B Reactor Building Hazard Assessment Report* (Griffin and Sharpe 1999), and the interim removal action EE/CA (DOE-RL 2001a) document the current status of these hazards within the facility. Information regarding hazardous substances in the facility is based primarily on S&M survey data, knowledge of construction materials, historical operations, and process knowledge of the facility and of analogous facilities in the 100 Areas. Information on the nature and extent of contamination is provided in Section 2.5. Primary references for the facility information are *"Pre-Existing" Conditions Survey of the Hanford Site Facilities to be Managed by Bechtel Hanford, Inc.* (BHI 1994), *Summary of 100-B/C Reactor Operations and Resultant Wastes* (Gerber 1993), *Risk Management Study for the Retired Hanford Site Facilities* (WHC 1993), and *Hanford Surplus Facilities Hazards Identification Document* (BHI 1997b). Additional information was obtained from the work experience with the 105-C, 105-D, 105-DR, 105-H, and 105-F Reactor ISS projects and related cleanup activities.

2.4.1 105-B Facility

The 105-B Facility (Figure 2-1) contains the reactor block, control room, spent fuel discharge area, FSB, fans and ducts for the ventilation and recirculating inert gas systems, water cooling systems, support offices, shops, and laboratories. The 105-B Facility is a steel reinforced concrete and concrete block structure. Within the 105-B Facility, reinforced concrete walls (0.9 to 1.5 m [3 to 5 ft] thick) extend upward to the height of the reactor block to provide shielding. The upper sections of the facility are constructed of concrete block (DOE-RL 2001a). Asbestos, radiological, and hazardous material contamination exists in the building.

The roof of the 105-B Facility is composed of precast concrete roof tile, except over the discharge area enclosure (the rear face) and the inner horizontal rod room. Over those areas, the roof is composed of 1.8-m (6-ft)-thick reinforced concrete (Gerber 1993). The original precast concrete tiles remain in place. Repairs have been made to individual precast roof panels that were showing signs of excessive deflection and corrosion (WHC 1994). The 105-B Facility underwent interim roof repair to replace flashing and mitigate drainage issues in fiscal year 2001. Total roof replacement is discussed in the *105-B Reactor Museum Feasibility Assessment (Phase II) Project* (BHI 2000) and will be contingent on the determination of the final configuration of the overall reactor structure.

Until September 11, 2001, guided public tours were conducted through a controlled portion of the building that has been deemed safe for supervised public entry. Entry requirements are imposed because hazardous substances were detected outside of the tour route during facility walkdowns and radiological surveys.

2.4.2 116-B Reactor Exhaust Stack

The 116-B Reactor Exhaust Stack is located adjacent to the southwest corner of the 105-B Facility and has been assigned the Waste Site Information Database (WIDS) code 132-B-2. The reactor stack is part of the 105-B Facility gas and exhaust air system. The stack has a concrete base with a diameter of approximately 4.9 m (16 ft) and a height of 61 m (200 ft) and is constructed of reinforced concrete. Associated with the site are an aboveground aluminum duct and an underground reinforced concrete duct. The site received low-level radiological contamination from the 105-B Facility (WHC 1994). The reactor stack is considered an ancillary facility and may pose chemical and radiological hazards.

2.4.3 Other Impacted Sites and Facilities

Three wooden sheds are present on the exterior of the 105-B Facility. The sheds include the 119-B Sample Building, a shed located on the 1608-B Waste Water Pumping Station, and a shed attached to the 116-B Reactor Exhaust Stack plenum. The sheds are potentially contaminated with hazardous materials, currently empty, and are addressed as part of the overall 105-B Facility. The 1608-B Waste Water Pumping Station is also considered part of the overall 105-B Facility.

Waste sites adjoining the reactor facility include the 1607-B2 Septic System including underground pipelines and the 120-B-1 Battery Acid Sump. Alternatives to remediate these waste sites were evaluated and approved in other CERCLA documents (EPA 1999b). The selected remedy for these sites was to remove contaminated soil and structures, treat as appropriate, and dispose. No other waste sites or facilities are anticipated to be impacted by activities described in this document. However, additional waste sites (e.g., french drains, pipelines) may be discovered or encountered during a removal action. These sites will be recorded and mapped as necessary, and remediated as necessary or referred to the final disposition of the 105-B Reactor in accordance with the surplus reactors EIS (DOE 1992).

2.5 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

Portions of the 105-B Facility and reactor stack are contaminated with chemical and radiological hazardous substances. To identify the hazardous substances in the facility, several sources of information were used, including results of S&M activities, characterization data, historical operations information, process knowledge, and knowledge of construction material. The primary hazardous substances of concern are radioactive materials.

In general, the primary radiological contaminants of concern include the following radionuclides:

- Tritium
- Carbon-14
- Cobalt-60
- Nickel-59, -63
- Strontium-90
- Technetium-99
- Cesium-137
- Plutonium isotopes
- Americium-241.

In addition, the 105-B Facility is expected to contain hazardous materials known to be present in most Hanford Site facilities, including the following:

- Polychlorinated biphenyls in oils and light ballasts
- Lead paint
- Lead shielding
- Mercury switches, gauges, and thermometers
- Mercury or sodium vapor lights
- Used oil from motors and pumps
- Friable and nonfriable forms of asbestos
- Sodium dichromate from water treatment chemicals
- Cadmium from oxidation of reactor control rods.

Contaminants are most likely to be contacted as adherent films and residues encrusted in or on deactivated process equipment, piping, and ventilation system ductwork. In addition, the FSB and associated transfer pit contain radioactive residues and sediments emitting gamma radiation.

2.6 RISK EVALUATION AND SITE CONDITIONS THAT JUSTIFY REMOVAL ACTION

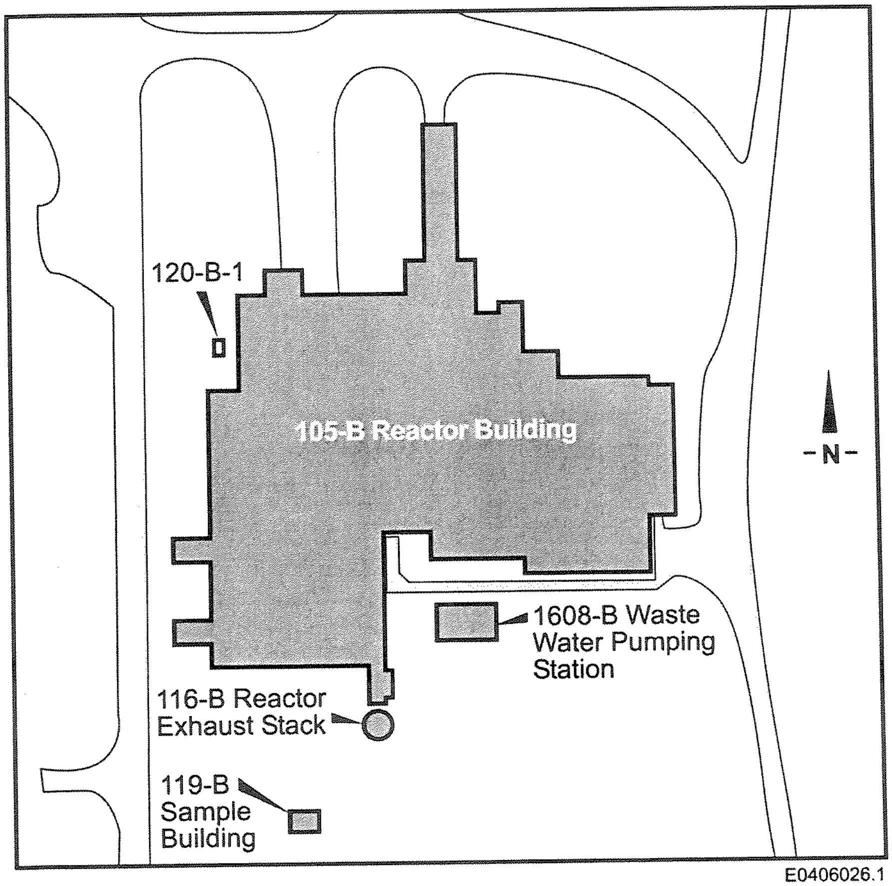
The reactor facilities and reactor stack addressed in this document are either known or suspected to be contaminated with radioactive and/or nonradioactive hazardous substances. Radionuclides are known to be carcinogenic. Potential radiation areas in the 105-B Facility include contamination areas in all below-grade areas, the top of the reactor, the inner and outer rod rooms, and working levels of the reactor. Potential airborne radioactivity areas would include the below-grade FSB area, gas tunnels, and the exhaust plenum. Below-grade portions of the FSB, transfer basin, sample rooms, and ball recovery systems are also known to contain sources of high radiation and/or contamination.

A security fence currently surrounds the area to limit unauthorized entrance into the area. In addition, the facilities are locked and require entry approval from the Facilities Decommissioning Project. As long as DOE retains control of the 100 Areas, these institutional controls may prevent direct contact with and exposure to the hazardous materials. However, institutional controls will not prevent deterioration of the facilities and potential release of contaminants to the environment. Contaminants could be released directly to the environment via a breach in a pipe, containment wall, roof, or other physical control as the facilities age and deteriorate. Contaminants could also be released to the environment indirectly through animal intrusion into the contaminated structures and systems. Historically, intrusion and spread of contamination by rodents, insects, birds, and other organisms has been difficult to control and prevent.

The current threat of a release of contaminants from the 105-B Facility is relatively low. Consequently, the risk to the public and environmental receptors is low. However, as the facilities continue to age and deteriorate, the threat of potential release of radionuclides and hazardous substances increases and it becomes more difficult to confine these materials from the environment. The S&M activities required to confine the hazardous substances may increase the risk of potential exposure to personnel. The potential exposure to the public and the environment, the threat of future releases, and the risks associated with contamination at the 105-B Facility justify a non-time-critical removal action.

To date, no extended use or sponsor with funding to preserve all or part of the 105-B Facility for historical purposes has been identified. Therefore, the DOE is proposing a removal action to protect the public and the environment from the risks associated with the contamination at the 105-B Facility.

Figure 2-1. 105-B Reactor Building, 116-B Reactor Exhaust Stack, and Adjacent Waste Sites.



3.0 CLEANUP ACTION OBJECTIVES

The 105-B Facility included in the scope of this EE/CA poses a threat to human health and the environment. The facilities contain radioactive and nonradioactive hazardous substances as surface contamination, matrix contamination, or within structural components. The removal alternative shall be conducted in a manner that is protective of human health and the environment.

In general, the scope of this removal action only addresses the facilities themselves and some underlying and surrounding soils. Soil contamination will be remediated as a part of the final disposition of 105-B Reactor under the authority of the surplus reactors EIS (DOE 1992). Based on the potential hazards identified in Sections 2.3 and 2.4, the following removal action objectives have been identified:

- Control the migration of contaminants from the facilities into the environment
- Protect human receptors from exposure to contaminants in facility structures above acceptable exposure levels
- Prevent adverse impacts to cultural resources and threatened or endangered species
- Achieve applicable or relevant and appropriate requirements (ARARs) to the fullest extent practicable
- Safely treat, as appropriate, and dispose of waste streams generated by the removal action
- Support actions for the final disposition of the 105-B Reactor.

4.0 REMOVAL ACTION ALTERNATIVES

The removal action alternative for the 105-B Facility and the reactor stack must be protective of human health and the environment and must not inhibit future remedial action operations for waste sites in the same geographical area. The removal action alternatives also must not inhibit the final disposition of the 105-B Reactor core.

As presented in Section 2.0, the principal threats to be addressed by the selected removal action alternative are radioactive and/or nonradioactive hazardous substances contained in and around the facilities and contaminated surfaces of the facilities. The reactor building has been deactivated and decontaminated to the extent feasible through removal of contaminated tools, equipment, and loose materials, and by applying fixatives to many contaminated surfaces. Uncontaminated structures (or portions of structures) associated with the facilities within this scope will be removed or otherwise addressed to facilitate implementation of the selected cleanup action. However, significant contamination remains, especially in portions of the facilities and equipment associated with the reactor core and liquid discharges. An aerial photograph of the 105-B Facility is provided in Figure 4-1.

4.1 PROPOSED REMOVAL ACTION ALTERNATIVES

Based on the above considerations, the following three cleanup action alternatives were identified:

1. Alternative One: No Action
2. Alternative Two: Interim Safe Storage
3. Alternative Three: Long-Term Surveillance and Maintenance.

A final CERCLA removal action will be selected after the alternatives have been evaluated and documented in a CERCLA decision document in accordance with Tri-Party Agreement Milestone M-093-25 (Ecology et al. 1998).

4.2 ALTERNATIVE ONE – NO ACTION

Evaluation of a no action alternative is required to provide a baseline for comparison with other alternatives. Under the no action alternative, no D&D or ISS activities would be performed, and current S&M activities would be discontinued. Public access to the facility would not be permitted under this alternative. Hanford Site institutional controls (e.g., fencing, posted signs) would be left in place to help minimize personnel, worker, and public entry to the facilities, but not maintained. No other specific controls would be established for the facilities covered by this document. Because the facilities would not be decontaminated and no action would be taken to stop the facilities from deteriorating, there would be an increased threat and likelihood that a release would occur, potentially exposing the workers, public, or environment to hazardous substances. In addition, the no action alternative would impede remedial action progress for waste sites located in the geographical area.

There is no cost associated with the no action alternative.

4.3 ALTERNATIVE TWO – INTERIM SAFE STORAGE

Alternative two consists of performing D&D of the entire 116-B Reactor Exhaust Stack and portions of the 105-B Facility, implementing ISS for the 105-B Facility, and disposing of all waste generated during the operations. Included in this alternative is construction of an SSE over the reactor block that would prevent advanced structural deterioration and potential release of radionuclides or other hazardous substances, followed by long-term S&M of the 105-B Facility until final disposition of the reactor block.

The goal of ISS is to ensure that the SSE structure provides durable, long-term storage and safe access for interim inspections for the duration of the ISS period. During this time period, the 105-B Reactor block would be prepared for final disposition. There would be no public access to the 105-B Facility under the ISS alternative. The ISS alternative would be implemented as described in the following subsections.

4.3.1 Decontamination and Demolition

The D&D portion of this alternative would consist of assessment, decontamination, and demolition (the waste disposal component is discussed in Section 4.5) of the reactor stack and portions of the reactor facility support areas, including the FSB, that are located outside of the reinforced shield walls surrounding the reactor block. Figure 4-2 shows the layout of the 105-B Reactor Building and the location of the reinforced shield walls.

Assessment would consist of radiological surveys and sampling, characterization, and preparation of all engineering and safety documents and work packages to perform the field work.

Decontamination would be required to prepare the facilities for demolition. Decontamination could be accomplished through a variety of methods such as scabbling, washing, or scaling. In general, when physical removal of contaminants is not feasible or cost effective, the contamination would be "fixed" so that the contaminants would remain attached to the construction materials and would be less likely to be disturbed during subsequent demolition activities. Methods of fixing contaminants in place include painting, applying asphalt, and spreading plastic sheeting. Specific to preparation for the ISS, loose contamination would be removed or fixed to the greatest extent feasible in accessible areas within the shield walls.

Facility decontamination would be performed to ensure worker safety by minimizing potential exposure during D&D. Decontamination would also reduce the potential for contaminated fugitive emissions. In addition, decontamination would reduce the protection required during D&D and potentially reduce waste volumes, thus reducing overall removal and disposal costs.

Demolition would apply to the reactor stack and portions of 105-B Facility and may be preceded by dismantling facility components, such as severing and removing ductwork or selectively removing facility walls or structures. Demolition generally means large-scale facility destruction using heavy equipment (e.g., wrecking ball, excavator with a hoe-ram, shears, and concrete pulverizer), explosives, or other industrial methods. Demolition of the reactor stack would consist of removing the above-grade structure. In some cases, demolition would also involve removing portions of the below-grade structures and underlying soil.

The first phase of demolition at the 105-B Facility would involve removing the reactor support areas and any associated foundations outside the reactor shield walls. Below-grade structures would be removed to a minimum of 0.9 m below surrounding grade. The second phase of reactor demolition would involve removing selected equipment, materials, and structural components from inside the reactor shield walls to prepare for the SSE.

Demolition methods would be selected based on the structural elements to be demolished, remaining radionuclide contamination, location, and integrity of the reactor shield walls. Any fixed contamination on sections of the structure to be demolished would be separated and disposed. Dust-suppression techniques would be employed during demolition activities.

4.3.2 Residual Contamination

The degree to which subsurface structures and any contaminated soil would be addressed during D&D would depend on a number of factors. One factor would be proximity to other waste sites. As described in Section 2.0, the 105-B Facility is adjacent to waste sites for which remediation is planned or underway. In those instances where an interaction between the 105-B Facility and a waste site occurs, the subsurface structures and soil at the facility would be addressed in coordination with those waste sites using the applicable ROD and cleanup standards for those sites.

If feasible, subsurface structures and contaminated soil would be characterized and evaluated at the time of D&D in accordance with the remedial action objectives for final disposition of the 105-B Reactor. This would involve sampling subsurface materials to determine if they meet the cleanup standards for protection of human exposure via direct contact, and protection of groundwater and the Columbia River. If soil contamination is known or suspected, the soil underlying the site would be characterized and evaluated against the cleanup standards. If the below-grade structures meet the requirements specified in the ROD, the remaining structures would be left in place. If the below-grade structures do not meet the risk level or process knowledge indicates that an area will likely not meet the specified cleanup levels, excavation would continue until the cleanup standards are achieved. Structural materials or soil that exceed cleanup criteria would be removed and disposed of at the Environmental Restoration Disposal Facility (ERDF).

If it is not feasible to remediate below-grade structures and soil at the time of D&D, the site would be recorded and mapped, and deferred to the final disposition of the 105-B Reactor in accordance with the surplus reactors EIS (DOE 1992).

For the 105-B FSB, it is anticipated that the subsurface structure and underlying soil would be addressed as part of D&D in accordance with the processes described previously. The remaining portion of the basin will be removed as part of D&D and disposed of at the ERDF or other approved facility. The basin structure would be sampled and characterized, as would the underlying soil. Upon completing D&D activities, a minimum of 1 m of clean fill/soil cover would be placed over any remaining below-grade structures and inert/demolition material, and would be graded to meet the surrounding terrain in such a manner that minimum infiltration of runoff precipitation would occur.

4.3.3 Construction of the Safe Storage Enclosure

The existing reactor shield walls, constructed of reinforced concrete 0.9 to 1.5 m thick, would be used as the primary enclosure for safe storage. Figure 4-2 shows the general layout of the 105-B Reactor Building and the anticipated footprint of the primary enclosure. Upon removal of the applicable components from inside the SSE and D&D of the reactor support areas surrounding the shield wall, a roof would be constructed to enclose the top of the reactor block and adjacent rooms. The roof would consist of structural steel and metal roof decking. The shield walls would support the roof. Openings between the new roof and top of the shield walls would be closed with wall panel siding similar to that of the new roof. Openings and penetrations within the shield walls would be closed: large openings would be sealed by concrete pourbacks, and smaller openings and penetrations would be closed by welded caps, foam sealant, or fire plugs (steel plates bolted in place), as appropriate. The final configuration of the building would feature the existing shield walls as the exterior of the building, a single-entry door that would be used for inspections, and a metal roof with siding that matches the roof installation. Figure 4-3 shows an aerial view of 105-B Reactor with the 105-C Reactor ISS structure in the foreground. The 105-B Reactor ISS would be similar in construction as the 105-C Reactor ISS.

A single-door entry into the SSE would be provided for limited access. The door would be welded shut to control access. Necessary ventilation ducting would be installed inside the SSE that would be connected to an external portable exhaust unit prior to entry for maintenance activities. A remote monitoring system would be installed inside the reactor enclosure so that key parameters could be monitored between S&M entries. The equipment associated with the monitoring and electrical power and lighting would be installed in a utility room located outside of the SSE so that entry into the SSE would not be necessary to service this equipment.

4.3.4 Long-Term Surveillance and Maintenance of the Safe Storage Enclosure

Long-term S&M would be required only for the 105-B Facility; all other structures would be demolished and removed. S&M activities associated with the SSE would be assumed to occur until final disposition of the reactor block, which is within 57 years. This time period corresponds to the time from the conclusion of the hazard mitigation/interim removal action (2011) to final disposition (2068) of the 105-B Reactor block in accordance with the surplus reactors EIS (DOE 1992).

By design, the SSE structure would require minimal surveillance. It would be equipped with remote monitoring equipment and would require physical entry once every 5 years. The design of the SSE structure would be such that no significant maintenance would be required.

4.3.5 Present-Worth Cost Estimates for Alternative Two

Detailed cost estimates for alternative two are provided in Table 4-1. The present-worth cost for alternative two is approximately $19.6 million.

The detailed present-worth cost estimates to implement this alternative were developed using actual costs from similar projects completed or in progress on the Hanford Site.

The estimated present-worth costs for ISS of the 105-B Reactor Building were based, in part, on the actual costs incurred for ISS of the 105-C, 105-D, 105-DR, 105-F, and 105-H Reactor facilities. These facilities are similar in design, operating history, and components to the 105-B Reactor Building and have incurred similar activities and generated similar waste volumes as those proposed for the 105-B Facility. Present-worth cost estimates are based on 2000 costs from Table 4-1 of the *Engineering Evaluation/Cost Analysis for the 105-D Reactor Facility and Ancillary Facility* (DOE-RL 2000a). The costs were converted to 2004 costs using the 7-year real interest rate on treasury notes and bonds from OMB Circular No. A-94, Appendix C (OMB 1992). The actual real interest rate used is 3.5%.

The estimated present-worth costs for the FSB transfer pit sediment removal are based on actual costs from sediment removal from 105-C Reactor FSB transfer pits in 1997. The 1997 costs listed on page 31 of the *105-C Reactor Interim Safe Storage Project Final Report* (BHI 1997a) were converted to 2004 costs using the 5-year real interest rate on treasury notes and bonds from OMB Circular No. A-94, Appendix C (OMB 1992).

The estimated present-worth costs for the D&D of the 116-B Reactor Exhaust Stack were based on actual costs for similar activities at the 105-D and 105-DR facilities (DOE-RL 1998a). The actual costs were converted to 2004 costs using the 5-year real interest rate on treasury notes and bonds from OMB Circular No. A-94, Appendix C (OMB 1992).

The present-worth cost associated with the preparation for transportation, transport, and final disposition of the 105-B Reactor block within the 57-year ISS period is not included in the scope of this document.

4.4 ALTERNATIVE THREE – LONG-TERM SURVEILLANCE AND MAINTENANCE

Alternative three would consist of long-term S&M of the reactor stack and the 105-B Facility, followed by D&D within 57 years of the S&M phase. In accordance with the action memorandum (DOE-RL 2001c) and Tri-Party Agreement milestone series M-093, hazard mitigation S&M would be conducted for the reactor stack for up to 10 years, by which time D&D of this structure must be completed. The reactor stack would be demolished and residual subsurface contamination would be managed as described for alternative two (Section 4.3). The 105-B Facility, however, would be in an S&M program for up to 57 years after the conclusion of the hazard mitigation/interim removal action, followed by D&D of the facility. Implementation of the S&M alternative would not include public access to the facility, and facility tours would not be conducted. The D&D phase of this alternative would be the same as described in alternative two (Section 4.3), not including preparation for ISS. Following D&D, the 105-B Facility would be left in a condition to immediately implement final disposition of the reactor block. An SSE structure would not be constructed under this alternative.

The S&M activities would include routine radiological and hazard monitoring of the facilities, safety inspections, and periodic confirmatory measurements of ventilation systems, as required. The S&M activities would be tailored to the specific condition of the facility. Activities would be balanced to reduce hazards to workers while reducing the potential for releases of contaminants to the environment. Major repairs such as reroofing and shoring structural components would be necessary for the 105-B Facility during the S&M period. These major repairs would be required to ensure the integrity of the facility, which is necessary to contain contaminants within the structure. It is anticipated that roof repair/replacement would be required for the reactor building five times during the S&M period, as the roofs typically have a 10-year repair cycle. Other major repairs would be performed at the reactor facility and reactor stack during their corresponding S&M periods on an as-needed basis.

As facilities age and deteriorate, S&M typically must become more aggressive and would involve increased frequency of required activities and a higher level of worker protection, which would increase cost. As cost increases, long-term S&M would become less viable. Uncertainties regarding the actual rate and nature of facility deterioration makes estimating the anticipated cost in future years difficult with any degree of reliability.

As the facilities continue to age and S&M is necessarily more aggressive, it may not be cost effective to prolong the S&M period for the 105-B Facility for the full 57 years. D&D of the reactor facility may be required sooner to ensure that contaminants would not be released to the environment. Without an increasingly aggressive S&M program, the threats associated with unplanned releases to the environment would increase. Conversely, an aggressive S&M program would require workers to enter facilities more often, and workers may be required to perform more invasive procedures to maintain the facilities, which would increase the potential for exposure to workers. Additionally, personal protection requirements to maintain the more aggressive program would continually increase, adding to the cost.

A variety of waste streams would be generated during performance of S&M that would be characterized, packaged, and disposed. Waste that meets the ERDF waste acceptance criteria would be disposed at the ERDF, and other wastes would be managed to comply with identified ARARs.

4.4.1 Cost Estimates for Alternative Three

Costs are presented in terms of present-worth cost in Table 4-2.

The total present-worth cost for alternative three is approximately $25.9 million. Present-worth cost estimates for long-term S&M at the 105-B Facility are based on 2000 costs from Table 4-2 of the interim removal action EE/CA (DOE-RL 2001a), which were converted to 2004 costs using the 5-year real interest rate on treasury notes and bonds from OMB Circular No. A-94, Appendix C (OMB 1992). Present-worth cost estimates for S&M at the 116-B Reactor Exhaust Stack are based on 1998 costs from the fiscal year 1999 multi-year work plan (DOE-RL 1998c), which were converted to 2004 costs using the 5-year real interest rate on treasury notes and bonds from OMB Circular No. A-94, Appendix C (OMB 1992). The present-worth costs were then summarized for the 57-year S&M period for the 105-B Facility (Table 4-2).

Costs have not been factored into the estimate to account for the increased demands on the S&M program that would be required over time, nor have costs associated with increased worker protection measures been included. Aside from the estimates for roof replacement and associated waste disposal costs that would be required on the reactor every 10 years, costs associated with other potential major repairs have not been included in the estimate because of the unknown frequency and magnitude of the required repairs. As a consequence, the reliability of cost estimates for this alternative is uncertain. Final disposition would be required by 2012 for the reactor stack and by 2068 for the reactor facility, respectively. The cost of D&D of the 105-B Facility and reactor stack (presented in Section 4.2) is included in this alternative. The D&D cost is quoted in present-worth terms and assumes that D&D would occur following the S&M period for the respective facilities.

The cost of preparation for transportation, transport, and disposal of the 105-B Reactor block is not included in the estimate.

4.5 COMMON ELEMENTS

Common elements that are shared between alternatives two and three include historical property management and waste management, as discussed in the following subsections.

4.5.1 Historical Properties Management

As presented in Section 2.0, the 105-B Facility meets the *National Historic Preservation Act of 1966* criteria for consideration as historically significant properties. Assessments of the properties have been completed. Physical effects to these eligible properties, up to and including demolition, have been mitigated in accordance with the stipulations of the Programmatic Agreement (DOE-RL 1996) and the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998b). Artifacts marked for retention will need to be retrieved and transported to an appropriate curation facility before any demolition activities.

4.5.2 Waste Management

Alternatives two and three would each generate waste that requires disposal at appropriate disposal sites. Waste management would be a common element for those alternatives.

Under each alternative, personnel would evaluate opportunities for waste minimization and pollution prevention, when economically feasible, for releasable material to reduce the volume of material disposed. Inert uncontaminated and decontaminated rubble that could not be recycled may be used to fill void spaces in the below-grade structures following demolition. Materials that can be effectively decontaminated and noncontaminated waste that can be effectively segregated from contaminated waste would be recycled or sent to an approved offsite facility for disposal. As an alternative, noncontaminated waste could be considered for use as fill material at the Hanford Site with prior approval from the Tri-Parties. Noncontaminated liquids that are encountered during the removal action could be used for dust suppression.

Waste for which no reuse, recycle, or decontamination options are identified would be assigned an appropriate waste designation (e.g., solid, asbestos, polychlorinated biphenyls, radioactive, dangerous, or mixed) and disposed of accordingly. The preferred pathway for disposal of contaminated waste would be the ERDF. Construction and operation of the ERDF was authorized via the *Record of Decision for the USDOE Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington* (ERDF ROD) (EPA 1995b). The ERDF is an engineered structure designed to meet *Resource Conservation and Recovery Act of 1976* (RCRA) minimum technological requirements for landfills, including standards for a double liner, a leachate collection system, leak detection, and a final cover.

In 1996, an explanation of significant difference (ESD) (Ecology et al. 1996) clarified the ERDF ROD (EPA 1995b) for eligibility of waste generated during Hanford Site cleanup activities. In accordance with the ESD, any low-level waste, mixed waste, and hazardous/dangerous waste generated as a result of CERCLA or RCRA cleanup actions (e.g., D&D, RCRA past-practice, and investigation-derived wastes) is eligible for ERDF disposal, provided that appropriate CERCLA decision documents are in place and that the waste meets ERDF waste acceptance criteria (BHI 2002b). Consequently, contaminated waste generated during the removal action proposed in this EE/CA would be eligible for disposal at the ERDF. Previous EE/CAs for other Hanford Site facilities have shown that the ERDF provides a high degree of protection for human health and the environment and is more cost effective than other disposal site options for comparable waste. Estimated waste volumes that would be generated for disposal at the ERDF would not be expected to significantly impact capacity limitations at the ERDF. The waste volumes in this document have been taken into account for ERDF planning purposes. Further discussions of the construction and operation of ERDF are not within the scope of this EE/CA.

While most waste generated during the removal action is anticipated to meet the ERDF waste acceptance criteria (BHI 2002b), some waste may require treatment before disposal. In most cases, the type of treatment anticipated would consist of solidification/stabilization techniques such as macroencapsulation or grouting. For waste that cannot be sent to the ERDF, it is expected that treatment, storage, and disposal can occur at other Hanford Site facilities such as the Central Waste Complex or the Effluent Treatment Facility. If waste were encountered that must be sent offsite for treatment or disposal, the EPA would make an acceptability determination for proposed facilities in accordance with 40 CFR 300.440.

Figure 4-1. Aerial View of the 105-B Reactor Facility and 116-B Reactor Exhaust Stack.

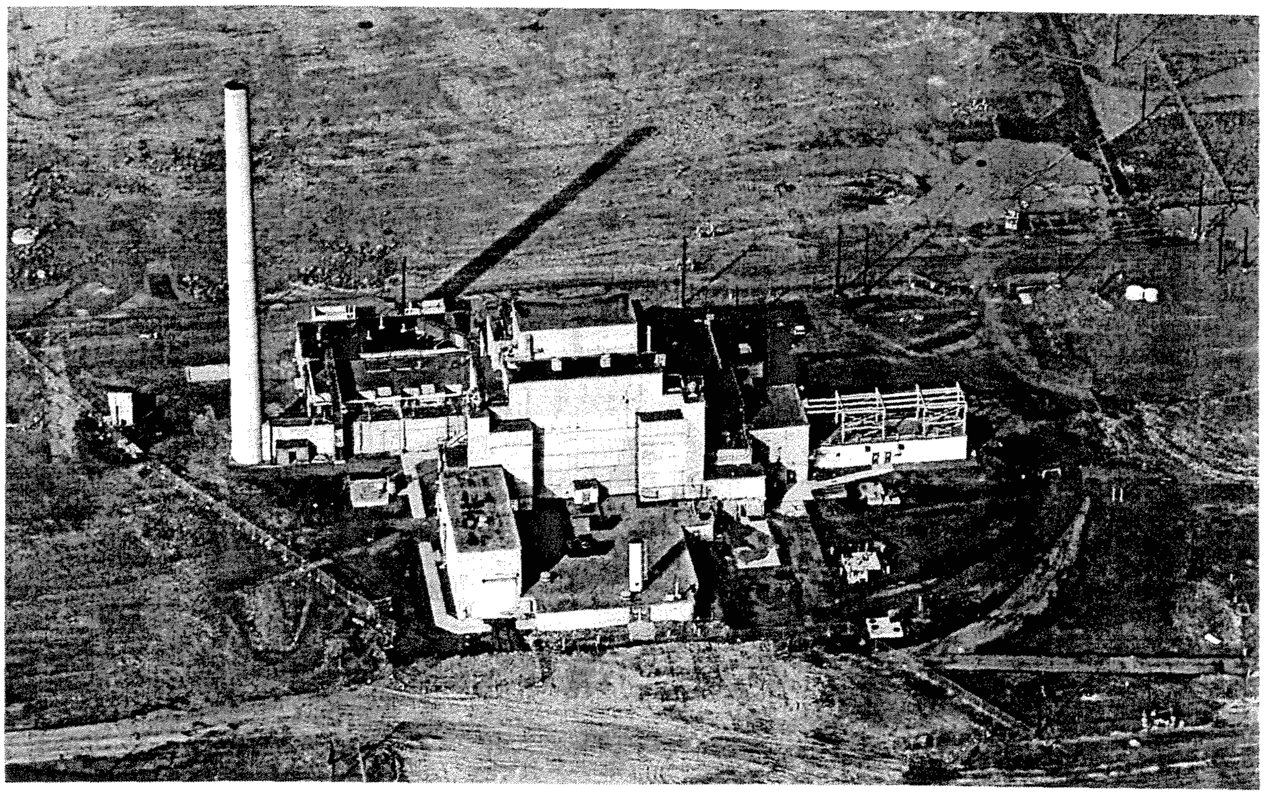


Figure 4-2. 105-B Reactor Building Identifying the Safe Storage Enclosure Area.

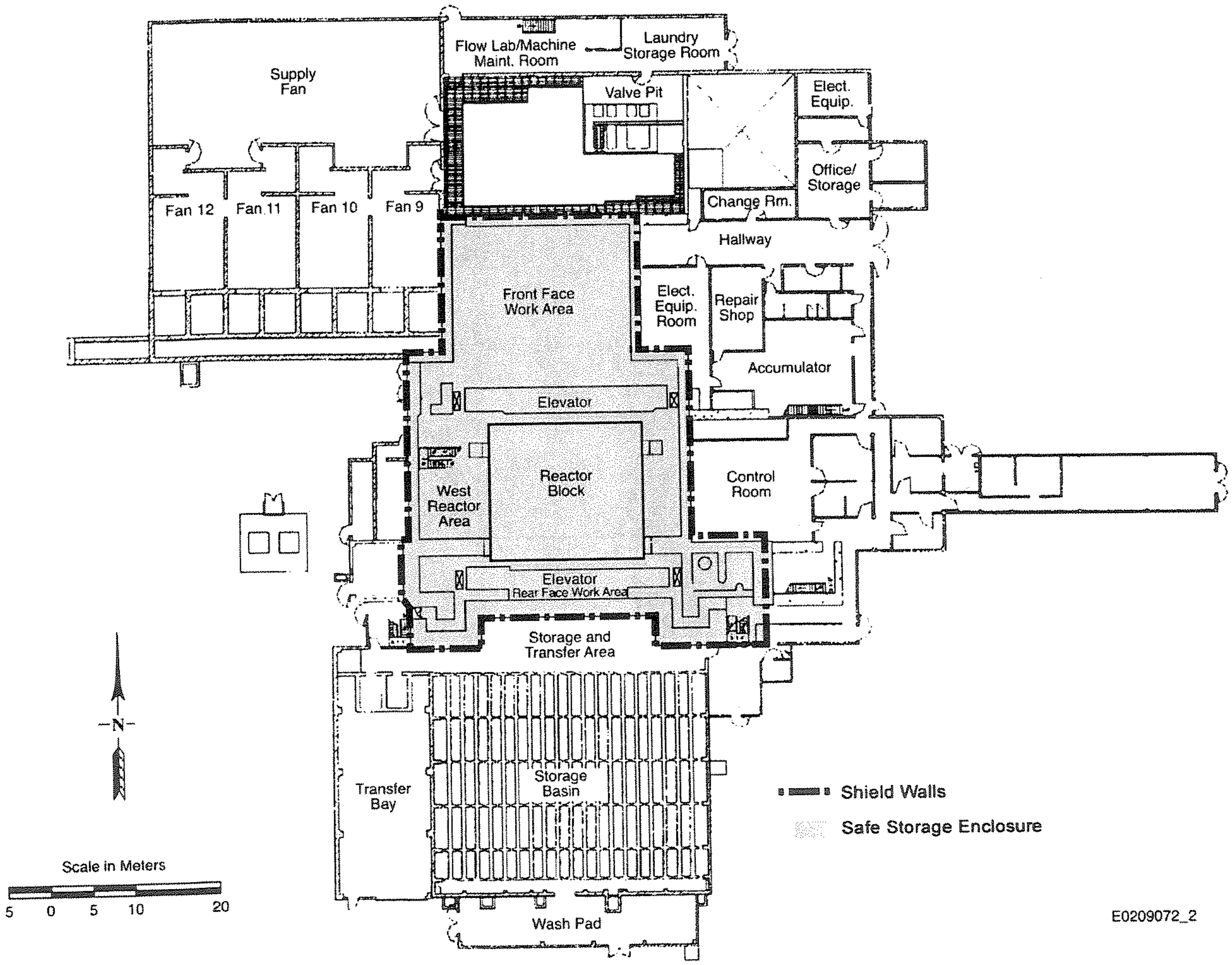


Figure 4-3. Aerial View of the 105-B Facility and the 105-C Reactor ISS Structure (Foreground).

Table 4-1. Present-Worth Cost Estimates for Alternative Two – Interim Safe Storage.[a]

Facility	Estimated Cost ($)
105-B Facility	
Sampling and analysis[b]	380,000
Engineering[c]	217,000
Demolition and construction of the SSE[d]	12,526,000
Equipment/materials[e]	1,510,000
Waste disposal[f] = 5,106 m^3	762,000
Basin structure removal to 4.6 m below surrounding grade	
D&D	1,296,000
Waste disposal[f]= 1,843 m^3	275,000
FSB transfer pit sediment removal	12,000
D&D Subtotal	**$16,980,000**
Post-construction S&M	706,000
Facility Total	**$17,686,000**
116-B Reactor Exhaust Stack	
D&D	1,778,000
Low-level waste disposal (approximately 1,337 m^3)	159,000
Asbestos-containing waste disposal (approximately 35 m^3)	1,000
Subtotal	**$1,937,000**
Total Present-Worth (2004 dollars) Cost	**$19,623,000**

[a] The costs given are based on Calculation Brief No. 0100B-CA-C0017 (BHI 2002a).
[b]Sampling and analysis: Costs associated with sample planning (e.g., data quality objectives and characterization plan), preparation, collection, and analysis. This activity provides pre-engineering information to assist in D&D planning and waste disposition planning.
[c]Engineering: Costs associated with all up-front engineering. Activity to include documentation associated with CERCLA planning, EE/CA, hazard classification, removal action work plan, etc.
[d]Construction: Costs associated with the actual demolition and safe storage of the reactor. This activity includes the demolition, the subcontract, and other field support activities, as well as continued engineering in support of the safe storage.
[e]Equipment and materials: Costs associated with the procurement of materials and the rental/lease of heavy equipment. Activity will cover all costs of equipment and materials starting from the pre-engineering walkdowns through the final site restoration activities.
[f]Waste disposal volume estimates were derived from actual waste volume shipments from ISS of the C Reactor. The waste volumes do not distinguish between waste type (e.g., low-level or mixed) because it is assumed that all of the waste will meet the ERDF waste acceptance criteria.

Table 4-2. Present-Worth Cost Estimates for Alternative Three – Long-Term Surveillance and Maintenance.[a]

Facility	Estimated Annual Cost ($)	Estimated Cost ($) for Life Span
Surveillance and Maintenance		
105-B Facility[b]	109,000	**6,194,000**
Roof Replacement on Reactor Building		
Roof repair/replacement each 10 years	537,500	--
Roof waste material disposal = 1,053 m^3	157,600	--
Total roof/repair replacement cost every 10 years (sum of replacement and disposal)	695,000	--
Six times per 64-year life span **(Subtotal)**		**$3,475,000**
Decontamination and Demolition		
116-B Reactor Exhaust Stack[c]	--	1,937,000
105-B Facility[d]	--	14,263,000
Subtotal	--	**$16,200,000**
Total Present-Worth (2004 dollars) Cost		**$25,870,000**

[a]The costs given are based on Calculation Brief No. 0100B-CA-C0017 (BHI 2002a).
[b]Cost estimate for a life span of 57 years.
[c]Cost estimates are the D&D and waste volume costs quoted in present-worth (2004) dollars (Table 4-1).
[d]Cost estimates are derived from the ISS cost for 105-B Reactor (Table 4-1) and subtracting the estimated cost for construction of the SSE, which is $2,717,000, and post-construction S&M, which is $307,000 (Table 4-1).

5.0 ANALYSIS OF ALTERNATIVES

The removal action alternatives were evaluated against three criteria: effectiveness, implementability, and cost. To provide a more comprehensive evaluation, this document divides the criterion of effectiveness into several subcategories as follows:

- Effectiveness:
  - Overall protection of human health and the environment
  - Compliance with applicable federal and state laws and regulations (e.g., ARARs)
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
- Implementability
- Cost.

Each criterion is briefly summarized in Table 5-1.

A detailed analysis of the no action, ISS, and long-term S&M alternatives being considered in this EE/CA relative to each criterion is provided in the following subsections, followed by a comparison of the alternatives against one another relative to each criterion. Results of the evaluation will be used to identify a preferred removal action alternative. Public acceptance of the preferred alternative will be evaluated after the public is given an opportunity to review and comment on this EE/CA. State acceptance will be evaluated by Ecology. After addressing comments, the Tri-Parties will document the selected removal action in an action memorandum.

5.1 EFFECTIVENESS

5.1.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the primary objective of the removal action. This criterion addresses whether the action achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. This criterion must be met for a removal action to be eligible for consideration. Evaluation of the alternatives against this criterion is based on qualitative analysis and assumptions regarding the inventory of hazards in the facility to be addressed by the removal action.

The no action alternative (alternative one) has no components that would eliminate, reduce, or control risks to human health and the environment. Implementation of this alternative would not meet removal action objectives or the threshold criterion for overall protectiveness and, therefore, cannot be considered a viable alternative. Consequently, the no action alternative was not carried forward for further evaluation in this EE/CA.

The ISS alternative (alternative two) would provide overall protection of human health and the environment. Substantial protection would be provided in the near term by conducting an assessment, performing D&D of portions of the 105-B Reactor, and constructing an SSE. The portions of the reactor facility outside of the shield walls would be demolished. All contaminated materials from the reactor stack and some contaminated materials from the reactor facility would be removed and disposed of at the ERDF, thus reducing the potential for a contaminant release. Openings in the shield wall containment would be sealed and the entire remaining structure would be encapsulated in a concrete and metal enclosure, reducing the potential for a release of remaining contaminants. During D&D and construction of the SSE, there would be a potential for worker exposure and the potential for release of contaminants. However, the use of proven control technologies and strict adherence to safety and environmental regulations during these activities would significantly minimize these risks. Additionally, lessons learned would be applied from the performance of this work conducted at the 105-C, 105-D, 105-DR, 105-F, and 105-H facilities. After construction of the SSE, S&M would be continued for up to 57 years until final disposition of the reactor is implemented. The number of areas that would require S&M would be reduced, thereby reducing the potential for exposing workers to contamination. Additionally, the reactor facility would be monitored remotely and internal inspections would be reduced to a 5-year schedule, further decreasing the potential for worker exposure.

The long-term S&M alternative (alternative three) would also provide overall protection of human health and the environment, although the ability to maintain protection as facility deterioration increases over time creates some uncertainty. For the duration of the S&M period (57 years for the 105-B Facility), continued surveillance and appropriate maintenance would provide protection. At the end of the S&M period, the facility would undergo final disposition (outside the scope of this EE/CA), which would provide more permanent protection as described in alternative two. There is a potential for worker exposure or a release of contaminants to the environment during the S&M period, and this potential would increase as the facility ages. However, the use of proven control technologies, timely maintenance, and strict adherence to safety and environmental regulations would reduce these risks. There are uncertainties regarding the ability to maintain the integrity and protectiveness of the 105-B Facility during the remaining S&M period. The number and magnitude of repairs would likely increase, and some repairs would potentially be insufficient to maintain facility integrity. No specific issues have been identified, but there would be risks associated with an unpredictable event.

Based on this analysis, alternative one would fail to provide overall protection. Both alternatives two and three achieve overall protection of human health and the environment, but alternative two is considered to do so more effectively than alternative three. Under alternative two, the areas of significant contamination would either be removed and disposed or sealed and protected to prevent release and allow for radioactive decay. Alternative three would require an increasingly more aggressive and difficult surveillance and repair effort as deterioration rates increase over time.

5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion addresses whether a removal action will, to the extent practicable, meet ARARs and other federal and state environmental statutes. The ARARs must be met to the extent practicable for onsite CERCLA actions (40 CFR 300.415(j)). Onsite actions are exempted from obtaining federal, state, and local permits (CERCLA, Section 121[e][1]). Nonpromulgated standards are also to be considered, such as proposed regulations and regulatory guidance, to the extent necessary for the removal action to be adequately protective. The ARARs criterion must be met for an alternative to be eligible for consideration.

Key ARARs associated with the two remaining alternatives include waste management standards, standards controlling releases to the environment, health standards, and standards for protection of cultural and ecological resources. The actions proposed for both alternatives would meet these preliminary ARARs, although the potential for noncompliance with standards for controlling releases to the environment and health standards for health could increase as the facility ages under alternative three. A detailed discussion of how the removal action alternatives would comply with ARARs is provided in Appendix A, including other advisories or guidance documents to be considered. Final selection of ARARs to be met during implementation of the selected removal action, will be documented in the CERCLA action memorandum associated with this EE/CA.

5.1.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion addresses whether the alternative leaves an unacceptable risk after the removal action has been taken. It also refers to the ability of a removal action to maintain long-term, reliable protection of human health and the environment after removal action objectives have been met.

Alternative two would be protective of human health and the environment for the long term. It would provide a permanent remedy for the portions of the facility that undergo D&D, because contamination and contaminated structures would be removed and disposed. The SSE structure would be designed, with proper maintenance and monitoring, to last for the expected duration of approximately 60 years until final disposition. This component of the alternative would effectively contain remaining contamination within the facility until final disposition is determined.

Alternative three has been effective in the short term and could be protective for the long term. However, efforts to maintain the necessary level of protection would become increasingly aggressive as the facility ages. Therefore, over the long term, effectiveness of this alternative to remain protective may diminish.

Alternative two is considered to achieve long-term protectiveness more effectively than alternative three. Under alternative two, the presence of the SSE structure would provide more effective long-term protection of human health and the environment for contamination remaining in the facility.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment technologies may be employed in a removal action. This criterion assesses whether the alternative permanently and significantly reduces the hazard posed through application of a treatment technology. This could be accomplished by destroying the contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of contaminants. Reduction of toxicity, mobility, and/or volume through treatment contributes to overall protectiveness.

Alternative two would generate a large volume of contaminated waste, some of which may require treatment to meet waste acceptance criteria at the ERDF (BHI 2002b) or other disposal facilities. Wastes generated would include contaminated equipment and structural materials, personal protective equipment, routine maintenance wastes, and expendable materials. The actual quantity of waste generated and potential treatment requirements cannot be estimated at this time.

Alternative three would generate a relatively small volume of waste compared to alternative two. Wastes generated would include personal protective equipment, routine maintenance wastes, roofing materials, and expendable materials. The actual quantity of waste generated and potential treatment requirements cannot be estimated at this time, but quantities would be expected to increase over time as the facility deteriorates and requires more extensive maintenance.

Alternative two is considered to reduce toxicity, mobility, and volume of wastes somewhat more effectively than alternative three because a greater volume of waste, and thus potential waste to be treated, would be generated under alternative two.

5.1.5 Short-Term Effectiveness

The short-term effectiveness criterion refers to an evaluation of the speed with which the remedy achieves protection. The criterion also refers to any potential adverse effects on human health and the environment during the implementation phases of the removal action.

Alternative two would result in a near-term increase in worker exposure and the potential for releases to the environment. Workers would be entering the contaminated facility and handling contaminated materials during D&D. Removal and disposal of contaminated materials would increase the potential for a release to the environment, especially to the air. As demonstrated on previous ISS and D&D projects at the Hanford Site, implementation of mitigation measures such as limiting workers' time in contaminated areas, providing appropriate protective clothing and equipment, stabilizing contaminated surfaces, and dust control would ensure that worker exposure and the potential for releases would be minimized. During the monitoring period following ISS, the potential for worker exposure would decrease dramatically because the inspection frequency would be reduced to once every 5 years and maintenance needs would be reduced. In addition, the potential for a release to the environment would decrease substantially due to the containment provided by the SSE.

Alternative three effectively would defer intrusive work on the 105-B Facility until final disposition so there would be no near-term increase in worker exposure or potential for releases. As long as the facility is controlled and maintained, S&M would be an effective method to prevent releases to the environment in the short term. In the near term, inspection frequencies and maintenance activities would likely continue at the current rate. However, it is expected that S&M would become more difficult and less effective at preventing releases as the facility ages and deteriorates. In addition, as the facility ages, facility entries and thus worker exposure would likely increase due to increased maintenance requirements.

Alternative two could be considered to have "achieved protection" when the D&D activities have been completed and the SSE has been constructed, in 2012. However, the current S&M activities at the facility already achieve protection and protection would be continued during the ISS implementation phase by implementation of appropriate mitigation measures. Alternative three would be protective immediately and would remain protective as long as S&M were to be effective.

Overall, alternative two is considered to provide greater short-term effectiveness than alternative three. Alternative two would have greater worker exposure and potential for releases during D&D and construction of the SSE, but this would be more than offset by the reduction in worker exposure and the reduced potential for releases during the S&M phase of alternative two as compared to alternative three. Both alternatives would be protective immediately.

5.2 IMPLEMENTABILITY

Implementability refers to the technical and administrative feasibility of a removal action, including the availability of materials and services needed to implement the selected solution.

Alternative two would be implementable. Environmental restoration workers at the Hanford Site are experienced in performing D&D, ISS, and waste disposal operations. The environmental restoration workers have successfully completed ISS for three of the Hanford Site surplus reactors, and are in the process of completing ISS for two additional reactors. Techniques and lessons learned from those projects would be applied to ISS of the 105-B Reactor. The specialized skills required to design and construct the SSE would be readily available within the current work force at the Hanford Site. Materials needed to complete the SSE would be easily obtained. In terms of waste disposal, the ERDF has been designated via the ERDF ROD (EPA 1995b) to receive CERCLA wastes generated on the Hanford Site that meet the ERDF waste acceptance criteria (BHI 2002b). The facility has been in operation for several years. Procedures for handling waste at the ERDF are well established. Therefore, the resources and processes for implementing ISS would be in place and available.

Alternative three would also be implementable. S&M techniques are widely used throughout the Hanford Site. Environmental restoration workers are currently providing S&M on several retired reactor facilities, including the 105-B Reactor. The procedures are in place and equipment and personnel to perform necessary repairs and maintenance are available. As time passes, the primary difficulty with implementation of S&M would be the increasing deterioration of the facility. The potential for releases and increased contamination could be significant as the facility roof deteriorates and underground piping systems corrode and degrade. Deteriorated underground systems would be difficult to detect and repair. This would result in possibly increasing the potential for worker exposure or physical hazards.

Alternatives two and three are judged comparable in implementability. In the near term, alternative three would be easier to implement. This alternative would not require the level of resources and personnel that would be required for alternative two. However, in the long term, implementation of alternative three may become more difficult as the facility ages and deteriorates. In contrast, alternative two would become more implementable in the long term. Under alternative two, S&M for the facility would be minimal and require significantly less resources and personnel than alternative three.

5.3 COST

The cost criterion evaluates the cost of the alternatives and includes capital, operation and maintenance, and monitoring costs. The cost estimates for the alternatives do not include costs required for final disposition of the 105-B Reactor.

The total present-worth cost of alternative two would be $19.6 million. Costs include conducting limited S&M following ISS until 2068. The cost estimates for alternative two have been based, in part, on the actual costs that have been experienced in implementing ISS for the other Hanford Site reactors, which have many cost components similar to alternative two.

The total present-worth cost of alternative three would be approximately $25.9 million. Costs include D&D of the 116-B stack by 2012, conducting surveillance and routine maintenance on the 105-B Facility from 2012 through 2068, and D&D of the 105-B Facility in preparation for final disposition. Also included in the estimate is roof replacement and repair for the 105-B Facility.

The present-worth cost of alternative two is about 24% lower than alternative three. The principal difference between the cost of the alternatives is cost of conducted S&M for 57 years prior to final D&D in preparation for final disposition of the reactor block. Alternative two is less costly than alternative three in terms of present-worth (2004) dollars.

5.4 OTHER CONSIDERATIONS

Secretarial policy (DOE 1994) and DOE O 451.1B require that CERCLA documents incorporate NEPA values (e.g., analysis of cumulative, offsite, ecological, and socioeconomic impacts) to the extent practicable in lieu of preparing separate NEPA documentation for CERCLA activities. The NEPA regulations (40 CFR 1502.16) specify evaluation of the environmental consequences of proposed alternatives. These include potential effects on the following:

- Transportation resources
- Air quality
- Cultural and historical resources
- Noise, visual, and aesthetic effects
- Environmental justice
- Socioeconomic aspects of implementation.

The NEPA process also involves consideration of several issues such as cumulative impacts (direct and indirect), mitigation of adversely impacted resources, and the irreversible and irretrievable commitment of resources. A NEPA values evaluation of the alternatives is presented in the following subsections. The no action alternative is excluded from the evaluation because it failed to meet the overall protection threshold criterion as documented in Section 5.1.

5.4.1 Transportation Impacts

Neither of the removal action alternatives would be expected to create any long-term transportation impacts. Alternative two would have short-term impacts on local Hanford Site traffic associated with transportation of waste, equipment, and personnel. Demolition debris and contaminated soil would be transported from the 100-B Area to the ERDF. Alternative two would also require hauling geologic material to the 100-B Area for backfill. All waste transportation would occur on the Hanford Site, primarily on roads where public access is restricted. Minimal offsite impacts would be expected from transportation of waste to offsite sanitary landfills.

Alternative two would also involve transportation impacts from supplying equipment and materials to the 100-B Area and from increases in the workforce traffic. This should have minimal impact on the transportation infrastructure.

Alternative three would have minimal transportation impact during implementation of long-term S&M. Use of roadways and traffic would be minimal.

If adverse impacts to transportation were to be detected, activities would be modified or halted until the impact is mitigated. Potential mitigation measures for transportation include preparing a transportation safety analysis to identify the need for specific precautions to be taken before any transport activities, closing roads during waste transportation, or use of the existing rail infrastructure.

5.4.2 Air Quality

Potential air quality impacts are associated with each alternative that have not been quantified, but these impacts would be minor based on experience with D&D and ISS activities at other facilities. Alternative two would have potential air quality impacts associated with fugitive emissions of contaminants during facility demolition. There would also be potential dust emissions associated with excavation of backfill at borrow sites and placement of the material in the 100-B Area. There would be little potential for air emissions with alternative three, assuming that S&M is effective in preventing releases to the environment. Potential emissions would be quantified during design to ensure that emissions are controlled to below allowable limits. No impacts on local or regional air quality would be expected as long as appropriate fugitive emission and dust control measures are implemented. Potential mitigation measures for air resources include the following:

- Removing or stabilizing facility contaminants before demolition
- Using local exhaust and containment systems during demolition
- Packaging and handling wastes to prevent releases
- Implementing dust suppression measures (both water and water treated with fixatives) to control fugitive dust
- Covering loads when hauling wastes and backfill materials.

An air monitoring plan would be prepared before beginning fieldwork.

5.4.3 Natural, Cultural, and Historical Resources

The potential impacts to natural, cultural, and historic resources are discussed in the following subsections.

5.4.3.1 Natural Resources. Natural resources include biological resources (e.g., wildlife habitat, plants, animals), physical resources (e.g., land, water, air), and human resources (e.g., remediation workers). As documented in Section 2.0, the area around the 105-B Reactor has been physically disturbed by construction and operation of the reactor, support facilities, and waste sites and there are minimal biological resources.

Potential impacts to biological resources would be a greater concern at the borrow sites required to support alternative two because these sites could be located in otherwise undisturbed areas. Potential adverse impacts at the ERDF, which is located in an area of high-quality shrub-steppe habitat, were addressed in the *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* (DOE-RL 1994b). Alternative two would also have positive impacts on biological resources because the potential for the release of contaminants would be minimized through removal and construction of the SSE. Potential impacts to air resources were discussed previously. For alternative two, there also would be a potential for impacts to land and water resources if contaminants were released during the removal action. As the facility is demolished, there would be a potential for precipitation to contact contaminants and carry them to the soil, where they could then migrate to groundwater. Measures that would be implemented to mitigate potential impacts include the following:

- Stockpiling clean topsoil during site preparation and using topsoil for backfill
- Minimizing the size of construction areas
- Performing ecological surveys before remediation
- Avoiding work in the area of a nest during the nesting season
- Locating borrow sites in areas that would only impact low-quality habitat, such as cheatgrass
- Revegetating disturbed areas, as applicable
- Making borrow sites deeper to minimize the lateral extent of disturbance
- Providing engineering/administrative controls and protective equipment for workers.

5.4.3.2 Cultural Resources. Because of the extensive ground disturbance resulting from construction of the 105-B Reactor and associated facilities, the likelihood of archaeological remains near the facility is remote, as discussed in Section 2.0. Cultural resources may be present at borrow sites, which are typically located in otherwise undisturbed areas. Adverse impacts to cultural resources could occur if such resources are encountered and appropriate mitigating actions are not taken. A cultural resource mitigation plan has been prepared to guide activities, including avoiding known cultural resources and traditional-use areas whenever possible, conducting cultural resource reviews before subsurface intrusion or building demolition, and training construction workers to recognize and report potential cultural resources. If cultural resources are encountered, the State Historic Preservation Office and Native American tribes would be consulted to determine appropriate actions for mitigation, resource documentation, or recovery in accordance with the *Hanford Cultural Resources Management Plan* (DOE-RL 2003).

5.4.3.3 Historical Resources. As documented in Section 2.0, the 105-B Reactor has been listed on the National Register for Historic Places because of its historic association with the Manhattan Project, the development of atomic energy, and the Cold War. Because of its significance as the first full-scale reactor in history, there has been substantial interest in preserving the history of the 105-B Reactor, with options up to and including maintaining the reactor facility in its entirety as a historical museum. In previous documentation, DOE proposed to keep the facility as a museum if funding resources could be identified (DOE-RL 2001a). To date no such resources have been identified, so DOE is proceeding with planning and preparations for ISS of the reactor. However, assessments of the facility have been completed and numerous artifacts have been marked for retention. These artifacts, as well as the items now used for display and interpretation of the facility, would need to be retrieved and transported to an appropriate curation facility before any demolition activities took place under alternative two.

5.4.4 Noise, Visual, and Aesthetic Effects

Alternative two would increase noise levels, but the impacts would be of short-term duration during removal actions and would not affect offsite noise levels. Positive impacts on visual and aesthetic effects would be realized. The existing footprint and skyline of the 105-B Facility would be reduced significantly.

5.4.5 Socioeconomic Impacts

Socioeconomic impacts from implementing either alternative would be minimal. In the near term, the work force required for alternative three would be small. In the long term, alternative three may require support from non-Hanford Site work forces, but the number of resources would not be large and this would not be expected to have a significant cumulative impact on the community. Personnel required to implement alternative two would be selected from existing S&M and remediation workforce resources at the Hanford Site, or the opportunity to fill these positions would be made available to subcontractors. The alternatives would meet the principles established by the Hanford Advisory Board Work Group for cultural/socioeconomic impacts and would allow for workforce transition to cleanup activities. Effects on community social services, public services, and recreation are likely to be imperceptible because so few employees would be involved. No mitigation measures have been identified for socioeconomics.

5.4.6 Environmental Justice

Health or socioeconomic impacts to any of the local communities would be minimal for both alternatives, so environmental justice issues (e.g., high and disproportionate adverse health and socioeconomic impacts on minority or low-income populations) would not be a concern.

5.4.7 Irreversible and Irretrievable Commitment of Resources

Removal actions at 105-B Reactor could require an irreversible or irretrievable commitment of resources, particularly land use and geologic materials. Both alternatives would result in land-use loss to some extent. Contamination above cleanup standards might remain at depth even after soil contamination is addressed, and this would require restrictions on deep excavations and well drilling. The S&M alternative would require land restrictions during the interim phase, at least until the final disposition is performed. There would also be land-use loss for ERDF disposal because the ERDF would need to be expanded to accommodate D&D waste.

Irretrievable and irreversible commitment of resources would occur with both alternatives in the form of petroleum products (e.g., diesel fuel, gasoline) and, for alternative two, geologic materials required to backfill and recontour the site following D&D. Geologic material would be obtained from onsite borrow pits. In addition, there would be a small increase in the amount of material required for the closure barrier at the ERDF.

5.4.8 Cumulative Impacts

Removal actions at the facility included in the scope of this EE/CA could have impacts when considered together with impacts from past and foreseeable future actions at and near the Hanford Site. Authorized current and future activities in the 100-B Area that may be ongoing during removal actions include soil and groundwater remediation and S&M of facilities. Other Hanford Site activities include D&D of a variety of facilities, soil and groundwater remediation, operation and closure of underground waste tanks, construction and operation of tank waste vitrification facilities, removal and storage of spent nuclear fuel from the K Basins, and operation of the Energy Northwest commercial reactor. Activities near the Hanford Site include a privately owned radioactive and mixed waste treatment facility, a commercial fuel manufacturer, and a titanium reprocessing plant.

Both removal action alternatives would have minimal impacts on transportation; air quality; natural, cultural, and historical resources; noise, visual, and aesthetic effects; public health; and socioeconomics. Impacts would be the same for the both alternatives, but would occur later for alternative three. Therefore, cumulative impacts (with respect to these values) are expected to be insignificant. Cumulative impacts could occur with respect to the irretrievable and irreversible commitment of resources and funding priority.

Alternative two would require excavation of geologic material from borrow sites for backfill and cover, resulting in an irretrievable and irreversible commitment of geologic materials. The proposed removal action would constitute only one of numerous actions requiring material for barriers and backfill at the Hanford Site. The total quantity of geologic materials required for Hanford Site actions was evaluated in a separate NEPA evaluation (DOE 1999).

Both alternatives could also require long-term land-use restrictions in the 100-B Area. As documented in Section 2.0, the future land use in the 100 Areas is anticipated to be conservation/ preservation. Consequently, the land-use restrictions that would be imposed by either alternative would be compatible with other decisions and would not result in a cumulative impact for land use.

Table 5-1. Summary of Evaluation Criteria.

Effectiveness[a]	**Overall Protection of Human Health and the Environment.** The primary objective and a "threshold" criterion that must be met for a removal action to be eligible for consideration. This criterion addresses whether the alternative achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. Assessments of the other evaluation criteria are also drawn upon. Evaluation of the alternatives against this criterion was based on qualitative analysis and assumptions regarding the inventory of hazards in the 105-B Facility.
	Compliance with Applicable or Relevant and Appropriate Requirements. Like overall protection of human health and the environment, compliance with ARARs is a threshold criterion that must be met for an alternative to be eligible for consideration. This criterion addresses whether a removal action will, to the extent practicable, meet ARARs and other federal and state environmental statutes. The ARARs must be met for onsite CERCLA actions (40 CFR 300.415(j)). Onsite actions are exempted from obtaining federal, state, and local permits (CERCLA, Section 121 [e][1]). Nonpromulgated standards (e.g., proposed regulations, regulatory guidance) are also to be considered to the extent necessary for the removal action to be adequately protective.
	Long-Term Effectiveness and Permanence. The long-term effectiveness and permanence criterion addresses whether the alternative leaves an unacceptable risk after the removal action has been completed. It also refers to the reliability of a removal action to maintain long-term protection of human health and the environment after implementation.
	Reduction of Toxicity, Mobility, or Volume Through Treatment. The reduction of toxicity, mobility, or volume through treatment criterion refers to an evaluation of the anticipated performance for treatment technologies that may be employed in a removal action. It assesses whether the alternative permanently and significantly reduces the hazard posed through application of a treatment technology. This could be accomplished by destroying the contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of contaminants. Reduction of toxicity, mobility, and/or volume contributes to overall protectiveness.
	Short-Term Effectiveness. The short-term effectiveness criterion refers to an evaluation of the speed with which the remedy achieves protection. This criterion also refers to any potential adverse effects on human health and the environment during the implementation phases of the removal action.
Implementability	Implementability refers to the technical and administrative feasibility of a removal action, including the availability of materials and services needed to implement the selected solution.
Cost	The cost criterion evaluates the cost of the alternatives and includes capital, operation and maintenance, and monitoring costs.

[a] To provide a more comprehensive evaluation, the effectiveness criterion has been divided into several categories.

6.0 RECOMMENDED ALTERNATIVE

This document presents three removal action alternatives for the 105-B Reactor Building and 116-B Reactor Exhaust Stack. The recommended removal action alternative for the facilities is alternative two, interim safe storage. This alternative is recommended based on its overall ability to protect human health and the environment and its effectiveness in maintaining protection for both the short term and long term. The alternative would also reduce the potential long-term threat to workers who could be exposed to facility contaminants during extended periods of S&M and would reduce the potential for a release by reducing the inventory of contaminants.

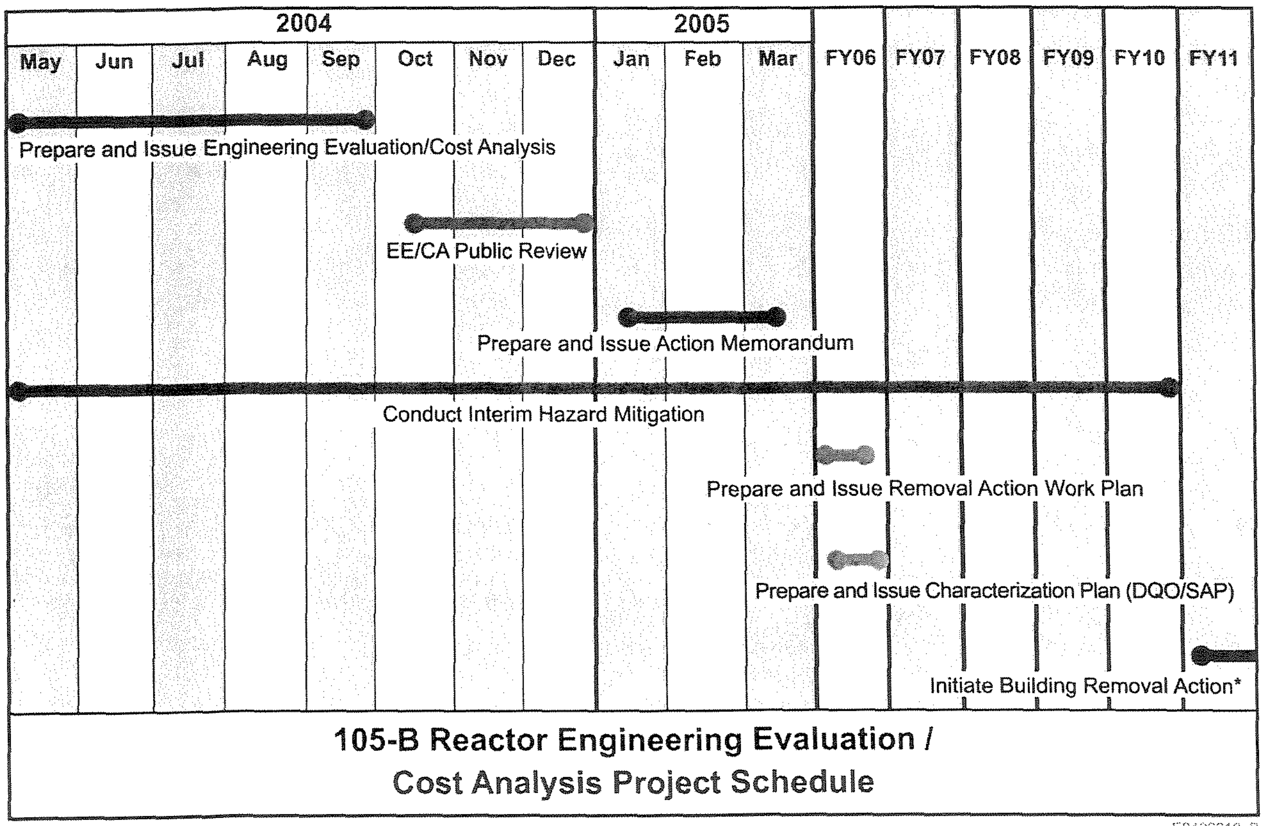
Alternative two would provide the best balance of protecting human health and the environment, protecting workers, meeting the removal action objectives, achieving cost effectiveness, and providing an end state that is consistent with future cleanup actions and commitments to the Tri-Party Agreement (Ecology et al. 1998). Implementation of alternative two facilitates a final disposition decision on the 105-B Reactor by removing much of the potentially contaminated materials, protecting the remaining contaminated structures, and allowing decay of remaining radioactive contamination until final disposition is accomplished.

Alternative two would involve assessment, complete D&D of the 116-B Reactor Exhaust Stack, partial D&D of the 105-B Facility, ISS of the remaining 105-B Facility, construction of the SSE structure over the 105-B Reactor block, waste disposal, and long-term S&M of the SSE structure. The ERDF would primarily be used for waste disposal, which provides an engineered disposal facility that is protective of the environment. Liquids containing levels of hazardous substances, meeting waste acceptance criteria, would be sent to the Effluent Treatment Facility. Any offsite waste disposal would require an acceptability determination by the EPA in accordance with 40 CFR 300.440, with notification to Ecology. Contaminants remaining in the 105-B Reactor block, enclosed in the SSE, would be substantially isolated and would allow for a significantly reduced S&M program.

7.0 SCHEDULE

For information purposes only, Figure 7-1 provides a projected schedule of the proposed removal action alternative. Sampling and analysis plans (for waste designation and final verification) and the identified removal action work plan will be submitted to the regulators for concurrence.

Figure 7-1. 105-B Reactor Complex Interim Safe Storage Proposed Project Schedule.



* This start date may be accelerated by DOE (with regulator concurrence) if another agency has not assumed responisbility of B Reactor.

8.0 REFERENCES

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations,* as amended.

40 CFR 300.415, "Removal Action," *Code of Federal Regulations*, as amended.

40 CFR 300.440, "Procedures for Planning and Implementing Offsite Response Actions," *Code of Federal Regulations*, as amended.

40 CFR 1502, "Environmental Impact Statement," *Code of Federal Regulations*, as amended.

50 CFR 17, "Endangered and Threatened Wildlife and Plants," *Code of Federal Regulations*, as amended.

58 FR 48509, "Department of Energy, Record of Decision, Decommissioning of Eight Surplus Reactors at the Hanford Site, Richland, Washington," *Federal Register*, Vol. 58, No. 178, pp. 48509, September 16, 1993.

64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)," Final Rule, *Federal Register*, Vol. 64, pp. 61615, November 12, 1999.

BHI, 1994, *"Pre-Existing" Conditions Survey of the Hanford Site Facilities to be Managed by Bechtel Hanford, Inc.,* BHI-00081, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997a, *105-C Reactor Interim Safe Storage Project Final Report*, BHI-01231, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997b, *Hanford Surplus Facilities Hazards Identification Document,* BHI-00066, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000, *105-B Reactor Museum Feasibility Assessment (Phase II) Project*, BHI-01384, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002a, *105-B Reactor Final Configuration Engineering Evaluation/Cost Analysis,* Calculation No. 0100B-CA-C0017, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002b, *Environmental Restoration Disposal Facility Waste Acceptance Criteria,* BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

DOE, 1992, *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington*, Addendum, DOE/EIS-0119F, U.S. Department of Energy, Washington, D.C.

DOE, 1994, *Secretarial Policy on the National Environmental Policy Act*, (Memorandum from H. O'Leary to Secretarial Offices and Heads of Field Elements, June 1994), U.S. Department of Energy, Washington, D.C.

DOE, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, DOE/EIS-0222-F, U.S. Department of Energy, Washington, D.C.

DOE and EPA, 1995, *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, May 22, 1995, U.S. Department of Energy and U.S. Environmental Protection Agency, Washington, D.C.

DOE O 451.1B, *National Environmental Policy Act Compliance Program*, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1994a, *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington,* DOE/RL-94-150, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1994b, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility,* DOE/RL-93-99, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996, *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington*, DOE/RL-96-77, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998a, *Engineering Evaluation/Cost Analysis for the 105-DR and 105-F Reactor Facilities and Ancillary Facilities*, DOE/RL-98-23, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998b, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*, DOE/RL-97-56, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998c, *Richland Environmental Restoration Project Baseline -- Multi-Year Work Plan, Vol. 2: Fiscal Year 1999 Baseline Cost Summary & Detail*, DOE/RL-96-105, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000a, *Engineering Evaluation/Cost Analysis for the 105-D Reactor Facility and Ancillary Facility*, DOE/RL-2000-45, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000b, *Threatened and Endangered Species Management Plan, Salmon and Steelhead*, DOE/RL-2000-27, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001a, *Engineering Evaluation/Cost Analysis for the 105-B Reactor Facility*, DOE/RL-2001-09, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001b, *Historic American Engineering Record B Reactor (105-B Building) HAER No. WA-164*, DOE/RL-2001-16, U.S. Department of Energy, Richland, Washington.

DOE-RL, 2001c, *Action Memorandum for Hazard Mitigation at the 105-B Reactor Facility*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2002, *The Hanford Site Historic District*, DOE/RL-97-1047, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2003, *Hanford Cultural Resources Management Plan*, DOE/RL-98-10, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1996, *U.S. Department of Energy Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington, Explanation of Significant Difference (ESD)*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1998, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Endangered Species Act of 1973, 16 U.S.C. 1531, et seq.

EPA, 1993, *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*, EPA/540/F-94/009, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1995a, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1995b, *Record of Decision for the USDOE Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1997, *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999a, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3, Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1999b, *Record of Decision for the 100 Area Remaining Sites*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2000, *Declaration of the Record of Decision: U.S. DOE Hanford 100 Area; 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington, D.C.

Gerber, M. S., 1993, *Summary of 100-B/C Reactor Operations and Resultant Wastes*, WHC-SD-EN-RPT-004, Westinghouse Hanford Company, Richland, Washington.

Griffin, P. W. and J. J. Sharpe, 1999, *Hanford B Reactor Building Hazard Assessment Report*, BHI-01282, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Griffin, P. W., Battelle Pacific Northwest Laboratories, and Parsons Environmental Services, Inc., 1995, *105-B Reactor Facility Museum Phase I Feasibility Study Report*, BHI-00076, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

Migratory Bird Treaty Act of 1918, 16 U.S.C. 703, et seq.

National Environmental Policy Act of 1969, 42 U.S.C. 4321, et seq.

National Historic Preservation Act of 1966, 16 U.S.C. 470, et seq.

Neitzel, D. A., 2001, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 13, Pacific Northwest National Laboratory, Richland, Washington.

OMB, 1992, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular No. A-94, Office of Management and Budget, Washington, D.C., retrieved July 31, 2002, from http://www.whitehouse.gov/omb/circulars/a094/a094.html#appendixc.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

Superfund Amendments and Reauthorization Act of 1986, 42 U.S.C. 11001, et seq.

WHC, 1993, *Risk Management Study for the Retired Hanford Site Facilities,* WHC-EP-0619, Volume 3, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *100-B Area Technical Baseline Report*, WHC-SD-EN-TI-220, Westinghouse Hanford Company, Richland, Washington.

9.0 BIBLIOGRAPHY

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.

36 CFR 800, "Protection of Historic and Cultural Properties," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emissions Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 191, "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste," *Code of Federal Regulations*, as amended.

40 CFR 260, "Hazardous Waste Management System: General," *Code of Federal Regulations*, as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 262, "Standards Applicable to Generators of Hazardous Waste," *Code of Federal Regulations,* as amended.

40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste," *Code of Federal Regulations,* as amended.

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations,* as amended.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations,* as amended.

40 CFR 266, "Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities," *Code of Federal Regulations,* as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations,* as amended.

40 CFR 270, "EPA Administered Permit Programs: The Hazardous Waste Permit Program," *Code of Federal Regulations*, as amended.

40 CFR 271, "Requirements for Authorization of State Hazardous Waste Programs," *Code of Federal Regulations*, as amended.

40 CFR 272, "Approved State Hazardous Waste Management Programs," *Code of Federal Regulations*, as amended.

40 CFR 273, "Standards for Universal Waste Management," *Code of Federal Regulations*, as amended.

40 CFR 279, "Standards for the Management of Used Oil," *Code of Federal Regulations*, as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.

43 CFR 10, "Native American Graves Protection and Repatriation Act of 1990," *Code of Federal Regulations*, as amended.

49 CFR 100-179, "U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials," *Code of Federal Regulations,* as amended.

50 CFR 402, "Interagency Cooperation – Endangered Species Act of 1973," *Code of Federal Regulations*, as amended.

65 FR 37252-37257, Presidential Proclamation 7319, "Establishment of the Hanford Reach National Monument," *Federal Register*, Vol. 65, No. 114, pp. 37252-37257, Tuesday, June 13, 2000.

American Antiquities Act of 1906, 16 U.S.C. 431, et seq.

ANL, 1993, *Manual for Implementing Residual Radioactive Materials Guidelines Using RESRAD, Version 5.0,* ANL/EAD/LD-2, Argonne National Laboratory, Argonne, Illinois.

ANL, 1994, *RESRAD-BUILD: A Computer Model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material*, ANL/EAD/LD-3, Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.

Archeological and Historic Preservation Act of 1974, 16 U.S.C. 469-469c.

Atomic Energy Act of 1954, 42 U.S.C. 2011, et seq.

BHI, 2000, *105-B Reactor Museum Phase II Project Supplemental Cost Estimate*, BHI-01385, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Bibliography

DOE-RL, 2001, *Hanford Site Biological Resources Management Plan,* DOE/RL-96-32, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Hazardous Materials Transportation Act of 1974, 49 U.S.C. 1801-1813, et seq.

National Register of Historic Places, National Park Service, U.S. Department of the Interior, Washington, D.C.

Native American Graves Protection and Repatriation Act of 1990, Public Law 101-601, 25 U.S.C. 3001 et seq., as amended, November 16, 1990.

Neitzel, D. A., 1999, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 11, Pacific Northwest National Laboratory, Richland, Washington.

PNL, 1989, *Hanford Cultural Resources Management Plan*, PNL-6942, Pacific Northwest Laboratory, Richland, Washington.

Toxic Substances Control Act of 1976, 15 U.S.C. 2601, et seq.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended.

WAC 232-012-297, "Endangered, Threatened, and Sensitive Wildlife Species Classification," *Washington Administrative Code*, as amended.

WAC 246-247, "Radiation Protection -- Air Emissions," *Washington Administrative Code*, as amended.

WAC 296-62, "Department of Labor and Industries," *Washington Administrative Code*, as amended.

"Washington Clean Air Act," *Revised Code of Washington*, Chapter 70.94, et seq.

APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ACRONYMS

ACM	asbestos-containing material
ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
LDR	land disposal restriction
PCB	polychlorinated biphenyl
RCRA	*Resource Conservation and Recovery Act of 1976*
TBC	to be considered
WAC	*Washington Administrative Code*

APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A.1 INTRODUCTION

40 *Code of Federal Regulations* (CFR) 300.415(j) requires that applicable or relevant and appropriate requirements (ARARs) be met (or waived) to the extent practicable during the course of removal actions. When requirements are identified, a determination must be made as to whether those requirements are applicable or relevant and appropriate. A requirement is applicable if the specific terms (or jurisdictional prerequisites) of the law or regulations directly address the circumstances at a site. If not applicable, a requirement may nevertheless be relevant and appropriate if (1) circumstances at the site are, based on best professional judgment, sufficiently similar to the problems or situations regulated by the requirement; and (2) the use of the requirement is well suited to the site.

To-be-considered (TBC) information is nonpromulgated advisories or guidance issued by federal or state governments that is not legally binding and does not have the status of potential ARARs. The TBCs complement ARARs in determining what is protective at a site or how certain actions should be implemented.

A preliminary assessment has identified the following key ARARs for the alternatives being considered in this document:

- Waste management standards
- Standards controlling releases to the environment
- Environment and health radiological standards
- Cultural, historical, and ecological protection standards.

Other standards that are not environmental standards (and thus not ARARs) but which must be met during implementation of the removal action, or that should be considered, include various U.S. Department of Energy (DOE), federal, and state worker safety standards. Final selection of the ARARs, which must be complied with during implementation of the selected removal action, will be documented in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) action memorandum.

A.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A discussion of how the interim safe storage and surveillance and maintenance removal action alternatives would comply with the listed preliminary ARARs is provided in the following sections. Where pertinent to the discussion of compliance, TBC items have also been included.

The no action alternative is excluded from the discussion because it fails to meet the threshold criterion for overall protection of human health and the environment as previously documented in Section 4.0 of this engineering evaluation/cost analysis.

A.2.1 Waste Management Standards

Applicable waste management standards are identified in the following subsections for hazardous/dangerous waste, polychlorinated biphenyl (PCB) waste, radioactive waste, and asbestos.

A.2.1.1 Hazardous/Dangerous Waste. Subtitle C of the *Resource Conservation and Recovery Act of 1976* (RCRA) governs the identification, treatment, storage, transportation, and disposal of hazardous waste. Authority for most of the Subtitle C provisions has been delegated to the state of Washington. State dangerous waste management regulations promulgated pursuant to this delegated authority and the *Washington Hazardous Waste Management Act of 1976* are codified in accordance with *Washington Administrative Code* (WAC) 173-303 and would be applicable to any dangerous wastes (under the state authority, the term "dangerous waste" is used instead of the term "hazardous waste") that may be generated under this removal action. The regulations require identifying and appropriately managing dangerous wastes and dangerous components of mixed wastes, as well as identifying associated treatment and disposal standards. Land disposal restrictions (LDRs) established under RCRA (40 CFR 268) and state regulations (WAC 173-303-140) prohibit disposal of restricted wastes unless specific concentration- or technology-based treatment standards have been met. The LDRs would be applicable to the treatment and disposal of dangerous or mixed wastes that may be generated during the removal action.

Dangerous and mixed wastes would likely be generated under both alternatives. At this time, it is expected that these wastes would be primarily characteristic dangerous wastes (e.g., lead-contaminated materials). Some listed dangerous wastes (e.g., organic solvents) may also be generated. Both characteristic and listed dangerous or mixed wastes would be designated and managed in accordance with the substantive provisions of WAC 173-303. The LDRs would be applicable to the treatment and disposal of dangerous or mixed wastes that may be generated during the removal action. Any wastes determined to be dangerous or mixed waste would be treated, as appropriate, to meet the standards of 40 CFR 268 and WAC 173-303-140 prior to disposal. For example, lead-contaminated waste could be encapsulated.

After treatment, as appropriate, dangerous and mixed waste that meets the requirements of the *Environmental Restoration Waste Acceptance Criteria* (BHI 2002) would be disposed at the Environmental Restoration Disposal Facility (ERDF), which is authorized to receive such waste. Any waste that does not meet the ERDF waste acceptance criteria (BHI 2002) would be staged within the area of contamination or sent to an onsite dangerous waste storage area meeting the substantive requirements of WAC 173-303 and subsequently disposed at an approved dangerous waste disposal facility. Offsite disposal would require an offsite determination in accordance with 40 CFR 300.440 from the U.S. Environmental Protection Agency (EPA), with notification to the Washington State Department of Ecology (Ecology).

A.2.1.2 Polychlorinated Biphenyl Waste. "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions" (as implemented by 40 CFR 761) regulates the management and disposal of PCBs and PCB waste. PCB-contaminated waste would likely be generated under both alternatives, and would be managed in accordance with 40 CFR 761 requirements for PCB remediation waste. The ERDF is authorized to accept nonliquid PCB wastes for disposal. All PCB waste that meets the waste acceptance criteria in BHI (2002) would be disposed at the ERDF. Any PCB waste that does not meet ERDF waste acceptance criteria would be staged within the area of contamination or sent to an onsite PCB storage area meeting the substantive storage requirements of 40 CFR 761.65 and subsequently transported offsite to an approved *Toxic Substances Control Act of 1976* waste disposal facility. Offsite disposal would require an offsite determination in accordance with 40 CFR 300.440 from EPA, with notification to Ecology.

A.2.1.3 Radioactive Waste. Radioactive wastes are governed under the authority of the *Atomic Energy Act of 1954*. The U.S. Nuclear Regulatory Commission performance objectives for land disposal of low-level radioactive waste are provided in "Licensing Requirements for Land Disposal of Radioactive Waste" (10 CFR 61, Subpart C). Although not applicable to DOE facilities, these standards are relevant and appropriate to any disposal facility that would accept radioactive or mixed waste generated under this removal action. Low-level radioactive waste would be generated under both alternatives being considered for this removal action. Provided that this waste meets the acceptance criteria, it would be disposed at the ERDF, which is authorized to receive low-level waste resulting from CERCLA activities.

A.2.1.4 Asbestos. The removal of asbestos and asbestos-containing material (ACM) is regulated under the *Clean Air Act of 1955* (as implemented by 40 CFR 61, Subpart M). These regulations provide standards to ensure that emissions from asbestos are minimized during collection, processing, packaging, and transportation. Handling of asbestos and/or ACM would be required for either of the removal action alternatives. Asbestos and/or ACM would be removed and disposed at the ERDF in accordance with the cited regulations, including appropriate packaging.

A.2.2 Transportation

The *Hazardous Materials Transportation Act of 1974* (as implemented by 49 CFR 100 through 49 CFR 179) governs the transportation of potentially hazardous materials, including samples and waste, on public roads. This regulation is applicable to any wastes or contaminated samples that would be shipped off the Hanford Site. Either alternative could require offsite transportation of contaminated waste and potentially contaminated samples. Compliance with this ARAR would be met through implementation of DOE orders and federal procedures.

A.2.3 Disposal

The disposal requirements for ERDF and other disposal facilities are presented in the following subsections.

A.2.3.1 ERDF. Because both alternatives would include disposal of waste at the ERDF, the ERDF waste acceptance criteria (BHI 2002) must be met. The ERDF waste acceptance criteria (which are a TBC item) define radiological, chemical, and physical characteristic criteria for disposal of waste at the facility.

A.2.3.2 Other Disposal Facilities. Waste generated during the implementation of either alternative that could not meet, or be treated to meet, the ERDF waste acceptance criteria would be stored or disposed at an alternate Ecology- and EPA-approved facility. Any waste disposal occurring off the Hanford Site would require an offsite determination in accordance with 40 CFR 300.440 by EPA, with notification to Ecology.

A.2.4 Standards Controlling Releases to the Environment

The proposed removal action alternatives have the potential to generate airborne emissions of pollutants.

The federal *Clean Air Act* and the "Washington Clean Air Act" (*Revised Code of Washington* Chapter 70.94) regulate both criteria/toxic and radioactive airborne emissions.
Under implementing regulations found in 40 CFR 61, Subpart H, and WAC 246-247, radionuclide airborne emissions from all combined operations on the Hanford Site may not exceed 10 mrem/yr effective dose equivalent to the hypothetical maximally exposed individual at the nearest unrestricted area where any member of the public may be. The WAC 246-247 also requires verification of compliance and the use of best available radionuclide technology or as low as reasonably achievable control technology. Radionuclide emissions from point sources, non-point sources and fugitive sources are to be measured. Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable methods for identifying emissions as determined by the lead agency.

WAC 173-400 and 173-460 establish requirements for emissions of criteria/toxic air pollutants. The primary source of emissions would be fugitive particulate matter. WAC 173-400-040 identifies general standards for control of fugitive emissions resulting from materials handling, construction, demolition, or other operations. WAC 173-460 would be relevant and appropriate to removal actions that require the use of a treatment technology that emits toxic air pollutants. Treatment of some waste may be required to meet the ERDF waste acceptance criteria prior to disposal for two of the alternatives. In most cases, the type of treatment anticipated would consist of solidification/stabilization techniques such as macroencapsulation or grouting and would not be subject the WAC 173-460 requirements. If more aggressive treatment is required, the requirements of the standard would be met.

Particulate emissions would be controlled through standard industrial practices including, but not limited to, application of water spray, fixatives, and/or temporary confinement enclosures/glovebag containments. Both alternatives are expected to comply with these standards.

A.2.5 Cultural, Historical, and Ecological Resource Protection Requirements

Requirements associated with archeological remains, human remains, historical artifacts, endangered species, and migratory birds are presented in the following subsections.

A.2.5.1 Archeological Materials. The *Archeological and Historic Preservation Act of 1974* provides for the preservation of historical and archeological data (including artifacts) that might be irreparably lost or destroyed as the result of a proposed action. The B Reactor is located in an area that is highly disturbed from past operations. The likelihood of encountering archaeological materials within the footprint facility would be low for either alternative. The likelihood would be greater at borrow sites from which backfill material might be obtained under the interim safe storage alternative. Awareness training would be provided to site workers to address this possibility. If archeological materials were discovered, a mitigation plan would be developed in consultation with the appropriate authorities.

A.2.5.2 Human Remains. The "Native American Graves Protection and Repatriation Act Regulations" (43 CFR 10) requires agencies to notify and consult with Native Americans likely to be culturally affiliated with human remains that are inadvertently discovered during project activities. It is unlikely that work proposed in this engineering evaluation/cost analysis would inadvertently uncover human remains. If human remains were encountered, the procedures documented in the *Hanford Cultural Resources Management Plan* (DOE-RL 2003) would be followed.

A.2.5.3 Historical Artifacts. The "Protection of Historic Properties" (36 CFR 800) requires federal agencies to evaluate all properties for their eligibility for listing in The National Register of Historic Places and to find ways to avoid, reduce, or mitigate the adverse effects of federal activities on any properties eligible for or listed in the National Register. A programmatic agreement that was prepared by DOE specifies how activities at the Hanford Site will comply with the requirements to identify, evaluate, and treat buildings and historic archaeological remains from the Hanford era (DOE-RL 1996). The accompanying treatment plan directs the process for evaluating properties on the Hanford Site and identifies those facilities that are contributing facilities recommended for individual documentation (DOE-RL 1998). The B Reactor has been identified as a historically significant property.

A.2.5.4 Endangered Species and Migratory Birds. The *Endangered Species Act of 1973* requires the conservation of critical habitat on which endangered or threatened species depend and prohibits activities that threaten the continued existence of listed species or destruction of critical habitat. The *Migratory Bird Treaty Act of 1918* makes it illegal to remove, capture, or kill any migratory bird or any part of nests or the eggs of any such birds. Although threatened and endangered species and migratory birds are known to be present in the 100 Areas, no adverse impacts on protected species or critical habitat resulting from implementation of either alternative would be anticipated because the removal action would be limited to areas highly disturbed from past operations. Potential impacts to biological resources would be of greater concern at borrow sites because they are located in otherwise undisturbed areas.

Activity-specific ecological reviews would be conducted to identify potentially adverse impacts before beginning fieldwork.

A.3 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations,* as amended.

36 CFR 800, "Protection of Historic Properties," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emissions Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations,* as amended.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations,* as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.

43 CFR 10, "Native American Graves Protection and Repatriation Regulations," *Code of Federal Regulations*, as amended.

49 CFR 100-179, "Transportation," *Code of Federal Regulations,* as amended.

50 CFR 402, "Interagency Cooperation – Endangered Species Act of 1973," *Code of Federal Regulations*, as amended.

Archeological and Historic Preservation Act of 1974, 16 U.S.C. 469-469c.

Atomic Energy Act of 1954, 42 U.S.C. 2011, et seq.

BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria,* BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland Washington.

Clean Air Act of 1955, 42 U.S.C. 7401, et seq.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

DOE-RL, 1996, *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington*, DOE/RL-96-77, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*, DOE/RL-97-56, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2003, *Hanford Cultural Resources Management Plan*, DOE/RL-98-10, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Endangered Species Act of 1973, 16 U.S.C. 1531, et seq.

Hazardous Materials Transportation Act of 1974, 49 U.S.C. 1801-1813, et seq.

Migratory Bird Treaty Act of 1918, 16 U.S.C. 703, et seq.

RCW 70.94, "Washington Clean Air Act," *Revised Code of Washington* 70.94, as amended.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

Toxic Substances Control Act of 1976, 15 U.S.C. 2601, et seq.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

WAC 246-247, "Radiation Protection -- Air Emissions," *Washington Administrative Code*, as amended.

Washington Hazardous Waste Management Act of 1976, as amended.

A.4 BIBLIOGRAPHY

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," *Code of Federal Regulations,* as amended.

29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.

29 CFR 1926, "Safety and Health Regulations for Construction," Code of Federal Regulations, as amended.

40 CFR 260, "Hazardous Waste Management System: General," *Code of Federal Regulations*, as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 262, "Standards Applicable to Generators of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 266, "Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities," *Code of Federal Regulations*, as amended.

40 CFR 300.440, "Procedures for Planning and Implementing Off-Site Response Actions," *Code of Federal Regulations*, as amended.

The National Register of Historic Places, National Park Service, U.S. Department of the Interior, Washington, D.C.

DOE O 460.1A, *Packaging and Transportation Safety*, as amended, U.S. Department of Energy, Washington, D.C.

EPA, 1987, *Revised Procedures for Planning and Implementing Off-Site Response Actions*, OSWER 9834.11, U.S. Environmental Protection Agency, Washington, D.C.

PNL, 1989, *Hanford Cultural Resources Management Plan*, PNL-6942, Pacific Northwest Laboratory, Richland, Washington.

WAC 232-012-297, "Endangered, Threatened, and Sensitive Wildlife Species Classification," *Washington Administrative Code*, as amended.

WAC 296-62, "Department of Labor and Industries," *Washington Administrative Code*, as amended.